AIR CONDITIONING HEATING AND VENTILATING

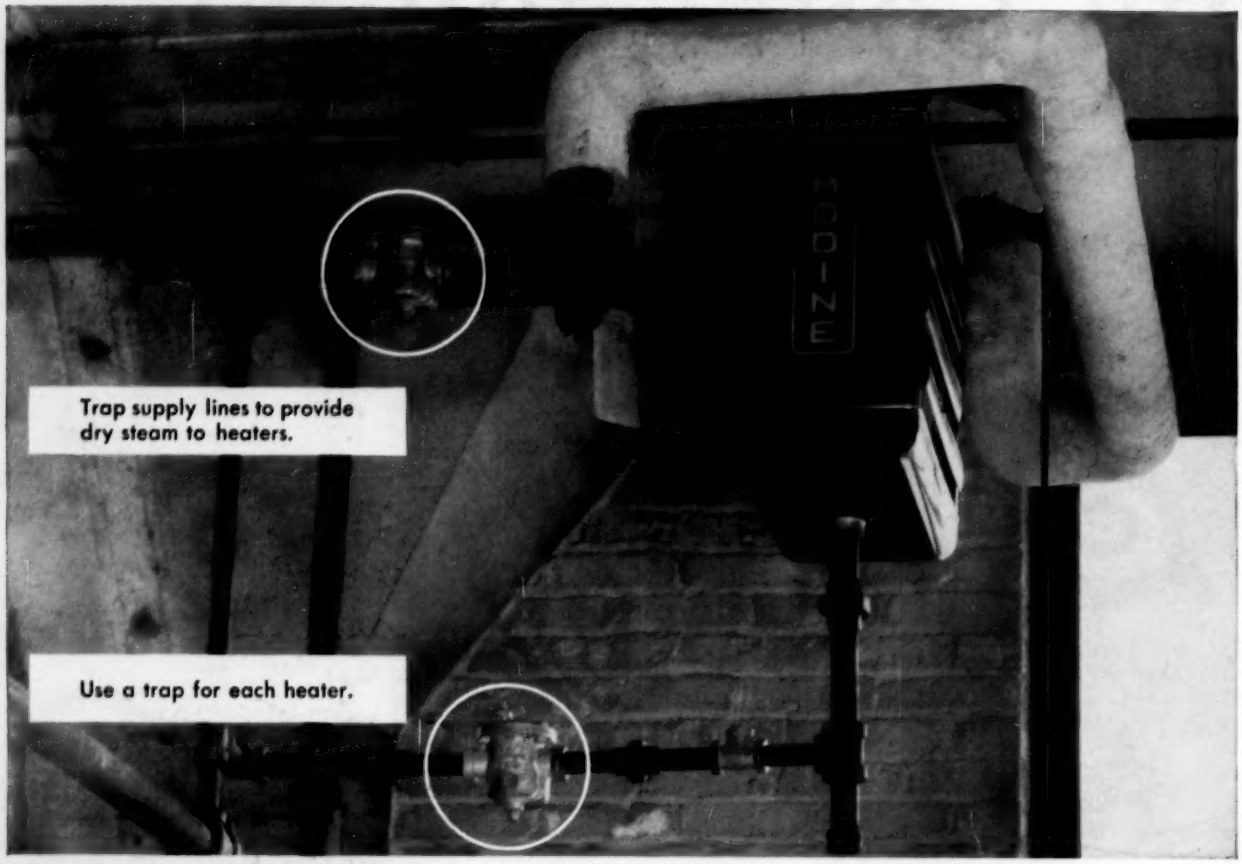
OCTOBER, 1955 – 52nd YEAR

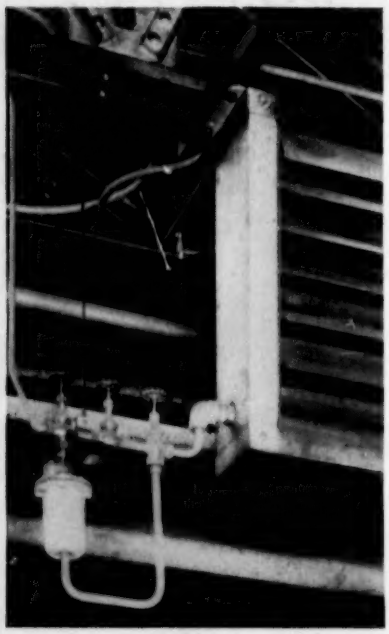
How to Cool Older Big Buildings—page 87

Fully Sun-Heated House—page 92

Warm Air Heating —page 103

Contents—page 3





Use a bypass above trap where heater must be kept in operation at all times. Note neat hookup possible with Armstrong vertical connection trap.

Tips on Trapping Unit Heaters for Full Output and Low Maintenance

• If unit heaters are clean and the steam supply and return lines are adequate, their performance will depend entirely upon the steam trapping. Here are some trapping pointers to insure plenty of heat when it is needed:

1. Trap supply lines to take care of condensate formed by radiation loss.

2. Use one trap for each heater. Two or more heaters drained by a single trap will fail to deliver maximum btu output.

3. Size traps properly. Many a unit heater is handicapped by a trap lacking adequate condensate and *air* handling capacity. The few dollars extra for larger traps insure fast heatup, full output and freedom from coil corrosion.

4. Install traps correctly. Put trap below and close to heater. Install a bypass around the trap if the heater must be kept in operation at all times. A shut-off valve in the discharge line facilitates trap inspection. Use of check valves and strainers is dependent upon piping conditions and the traps used.

5. Protect against PRV failure where freezing could occur. Sometimes heaters supplied with reduced pressure steam are installed where freezing could occur if traps failed to open. In this case select traps that will open at maximum steam supply pressure and still have adequate capacity at reduced pressure.

FREE ON REQUEST—COMPLETE INFORMATION on the above points, diagrams, selection data, tables and additional recommendations are contained in Armstrong Bulletin No. 2312. Also includes BTU output ratings for all models of 30 makes of unit heaters. Call your local Armstrong Factory Representative or write:

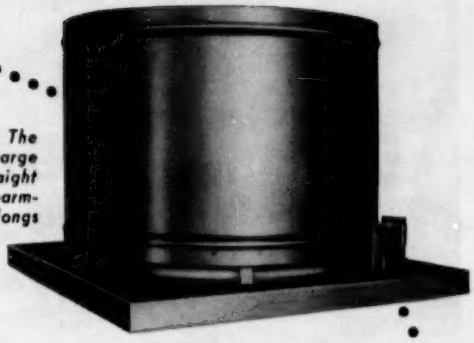
ARMSTRONG MACHINE WORKS
846 Maple Street • Three Rivers, Michigan

STEAM TRAPS FOR EVERY REQUIREMENT — APPLICATION ENGINEERED

ARMSTRONG STEAM TRAPS

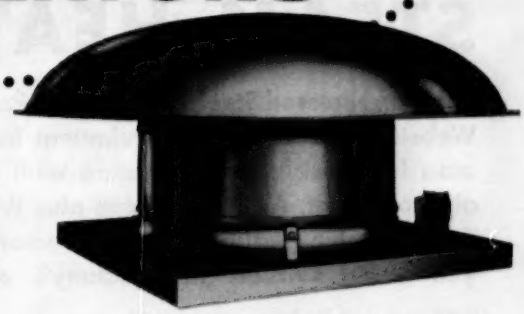
***For whisper-quiet operation** on schools, hospitals. The all-new Centrifugal Roof Ventilator runs at low speeds, moves large volumes of air efficiently against static pressures.*

***For oil or grease laden air.** The newly redesigned Vertical Discharge Roof Ventilator exhausts air straight up at high velocity. It keeps harmful residue off the roof . . . prolongs roof life.*



3 new LOW-SILHOUETTE ROOF VENTILATORS

Low in silhouette . . . distinctively profiled . . . these units blend well with modern architecture. What's more, they deliver all the air you pay for. All performance ratings are the output of the *completely assembled* unit . . . obtained from wind tunnel tests as per Standard Test Code for Power Roof Ventilators . . . conform to U. S. Department of Commerce Standard 178-51. Capacities up to 40,900 CFM. Send for catalogs today.



The Power-Flow Roof Ventilator is a ruggedly built unit in an aerodynamically correct, weatherproof housing. Most popular of all for general useage.

3 New catalogs

MAIL COUPON TODAY

De Bothezat FANS
A DIVISION OF
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

DeBOTHEZAT FANS, Dept. HV-1055
Division of American Machine and Metals, Inc.
East Moline, Illinois

Please send catalogs on your following roof ventilators . . .

- ☐ *Centrifugal,* for quiet operation
- ☐ *Vertical Discharge,* for oil or grease laden air
- ☐ *Power-Flow,* for normal industrial air
- ☐ All three ventilators

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ATTENTION MR. _____

Aerial view of Standard Pressed Steel Co., Jenkintown, Pa. Architect: Richard Pullinger. Engineer: Widdicombe Engineering Co. Heating Contractor: Bowers Brothers Co. General Contractor: Townsend & Elfreth.

World's Largest Socket Screw Plant STEAM-HEATED by WEBSTER

Standard Pressed Steel, Jenkintown, Pa., uses Webster Steam Heating Equipment in plant area for quick, flexible heating with ample air movement. Air conditioning plus Webster Tru-Perimeter Heating with Walvector gives year-round comfort to company's offices.

SPS — world's largest manufacturer of socket screw products — completed its $10,000,000 expansion program in four years, doubled its floor space to more than 600,000 square feet.

Webster Unit Heaters provide both heat and ventilation in the manufacturing portion of the plant. Webster Walvector offsets heat loss below windows. Other Webster Heating Equipment on the job for SPS includes Webster Radiator Traps, Valves and Dirt Strainers.

In the air-conditioned offices, Webster Tru-Perimeter Heating with Walvector assures winter-long warmth. Gentle, even heat along cold perimeter walls gives draft-free comfort even next to windows.

For any industrial plant, large or small . . . any office building . . . any commercial building . . . investigate the advantages of Webster Tru-Perimeter Heating with steam or forced hot water. See your Webster Representative, or write us.

Address Dept. HV-10

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In Canada, Darling Brothers, Limited, Montreal

Webster Walvector in Engineering Department provides a blanket of gentle heat along the entire window area.

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For Steam or Hot Water Heating

AND **Other Webster Heating Equipment includes Webster Baseboard also used in Tru-Perimeter Heating; Webster Convectors; Webster Process Steam Traps; Webster Moderator Systems of Steam Heating, and continuous flow controls for hot water heating. Data on request.**

AIR CONDITIONING HEATING AND VENTILATING

OCTOBER, 1955

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CONTENTS

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FEATURED ARTICLES

Air Conditioning Existing Big Buildings—C. L. Ringquist 87
Hotter Profits from Cooler Livestock 91
Fully Solar-Heated House—R. W. Bliss Jr. 92
Temperature Controls for House Heating Boilers—H. L. Mohn 98
Gravity Warm Air Heats Basementless House 102
Air Conditioning Important for Food Stores 131
Plumber and Pipefitter Apprentice Contest 132

REFERENCE MATERIAL

Section—Warm Air Heating—S. Konzo 103
Detail Sheet—Standpipe Systems 127
Data Sheet—Steam Losses from Steel Piping ..... Opposite 188

DEPARTMENTS

High Spots 5
Washington Overtones—L. Overman 6
Briefly Stated 10
Piping and Plumbing—L. Blendermann 129
Temperature Forecast 134
News of Equipment and Materials 135
Ad-Digest 153
Inquiry Information 153
News of the Month 162
New Catalogs 172
Coming Events 178
Index to Advertisers 187

The Cover: Large air-heating collector and a smaller domestic water-heating collector are installed behind solar heated house at Grasslands Station, Arizona. System was designed by Donovan and Bliss. See page 92.

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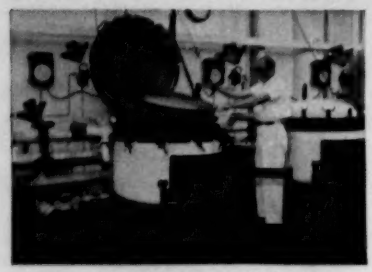
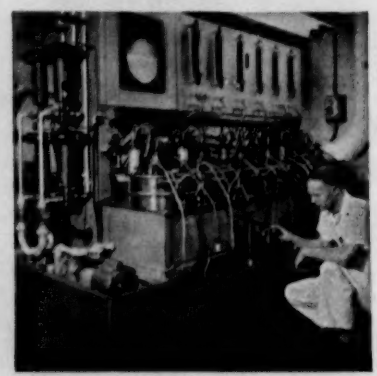
Shaker room and incubator in Fermentation Department. Powers Temperature Recording Controllers are used here.



Ampoule Sterilizers regulated by Powers No. 252 Pressure Regulators and Valves.



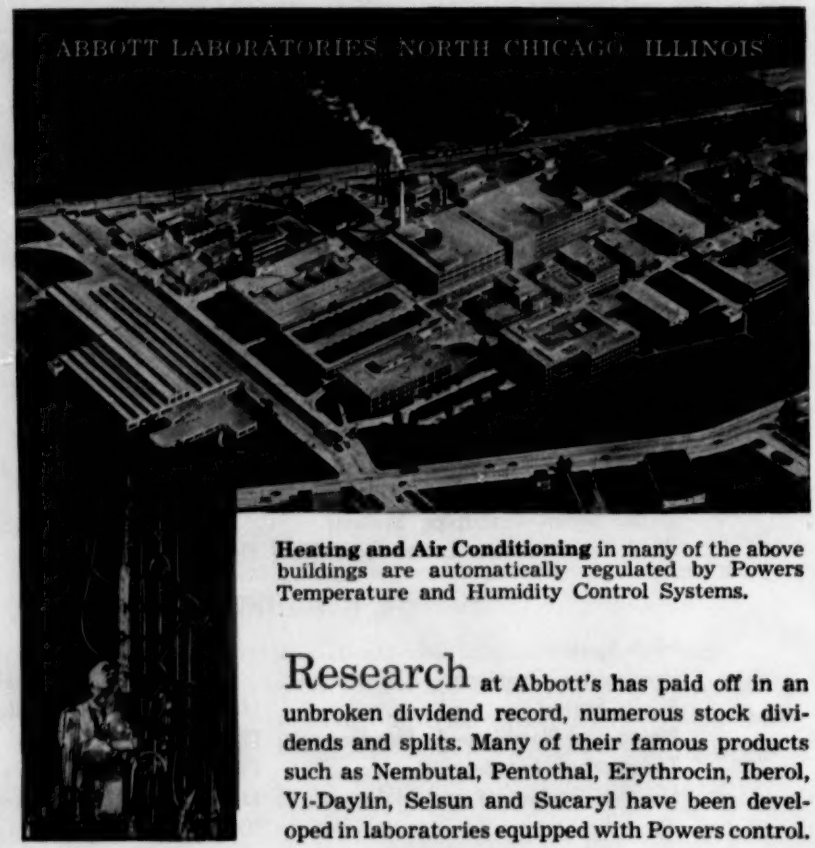
Fermentation process in research pilot plant controlled by Powers ACCRITEM Regulators and FLOWRITE Valves.

A few of the many vacuum dryers equipped with Powers Temperature Controllers.

Below: Air Conditioned Room for Board of Directors and executive conferences.

POWERS *AUTOMATIC* temperature, humidity and pressure control

.... helps Abbott Laboratories bring better health to millions



Heating and Air Conditioning in many of the above buildings are automatically regulated by Powers Temperature and Humidity Control Systems.

Research at Abbott's has paid off in an unbroken dividend record, numerous stock dividends and splits. Many of their famous products such as Nembutal, Pentothal, Erythrocin, Iberol, Vi-Daylin, Selsun and Sucaryl have been developed in laboratories equipped with Powers control.

Versatility of Powers control used at Abbott's is indicated by some of the applications shown here and in the following installations: Air conditioning control systems for auditorium with 900 seating capacity, executive offices and dining room, cafeteria and animal rooms; also controls for tablet machines, demineralized water heaters, autoclaves and many other applications.

When you need automatic control for temperature, humidity or pressure, call your nearest Powers office or write us direct. An experienced Powers engineer will gladly help you select the right type of control for your requirements.

(c42a)

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

Over 60 years of Automatic Temperature and Humidity Control

HIGH SPOTS

• Indications are that **dwelling starts** for the last half of 1955 will be at a **moderately lower rate** than for the first half, according to Standard & Poor's industry survey. Total outlays for construction, however, are expected to be slightly higher for the final 6 months, and total for the year is estimated at $39.5 billion, up about 6.5% from 1954, and the highest on record.

• **Water pollution control** measures came to the attention of 21 state legislatures this year. New or **more stringent laws** were enacted in 10 states, while 8 states enacted financing bills. See News department.

• A new look at the **chemistry of air pollution** was taken by engineers at the September meeting of the American Chemical Society when reports from many laboratories indicated that tons of combustion and process effluents in the air are activated chemically by sunlight and recombine to form **new, irritant, and corrosive compounds.**

• Owners of air conditioned homes in 23 states surveyed by Worthington Corp. confirmed **10 advantages of conditioned air** and reported: Improved appetites (63%), more hot meals in summer (75%), improved dispositions (58%), more free time (43%), more energy (63%), improved general health (65%), fewer colds (40%), less suffering from allergies (48%), less street noise (75%), less cleaning and dusting (65%).

• The Voice of America was bothered last summer by low frequency **interference from air conditioning machinery.** In spite of elaborate provisions, including floating six entire studios within the building on vibration isolators, vibrations from the seven compressors in the basement somehow run up to the microphone through its stand and make certain recordings sound as though they were made on sub-standard equipment. Corrective measures were delayed until the end of the summer when compressors could be shut down.

• The Climatic Research Committee of the Building Research Advisory Board has completed a survey of the major segments of the building industry to determine the **kinds of weather data needed** in addition to information now available. Some data, such as simultaneous dry bulb and wet bulb temperatures, have been observed but cannot be processed without additional facilities. Further observations are needed for soil temperatures and microclimatic information. More research is needed for long range forecasts and nocturnal radiation data. Data on summer degree-days and solar radiation cannot be developed without **further definition by industry.**

• **Copper and brass** mill workers of Connecticut's Naugatuck valley have pitched in to dig out from under tons of mud and debris left by the disastrous flood of August 19. Copper and Brass Research Association reports on a survey of the area show that rapid recovery is being made and **production has already resumed** in damaged plants of most member companies.

• Two **air conditioned subway cars** were tested in New York during August. One was run on the Hudson and Manhattan Railroad between Hudson Terminal and Hoboken, N. J., as forerunner to an attempt to build up declining passenger traffic. Another car with mechanical cooling was put into service on the Flushing line by the city Transit Authority. Cars feature 10 to 12 tons of cooling capacity.

• A new device which uses **refrigerated air to deaden pain** in dental patients was tested at the Navy's dental school. Temperature of the air stream is gradually dropped from 98 to 33.8 deg F, anesthetizing gum tissues. Later it is warmed again to body temperature. Ninety-four of 100 patients reported no pain.

• Philadelphia and Reading Coal and Iron Co., for years the second ranking producer of anthracite, has **entered the underwear business** with purchase of Union Under Wear Co. and changed its name to Philadelphia and Reading Corp. in a major diversification program.

• A huge increase in sales of **car air conditioning** has been predicted by Ward's Automotive News which said also that General Motors is testing a packaged conditioner that might go under the rear seat and obviate special wiring and ducts.

WASHINGTON OVERTONES

by LORING OVERMAN

Why Congress was so ready to adjourn in August with so much business unfinished is a "Washington overtone" of **importance to all business.**

Fact is, the period of adjournment is sort of a between-quarters rest interval. When play is resumed, pending legislation will be taken up at whatever point it was halted by adjournment. Meanwhile, members of the legislative team will have had an opportunity to **check with constituent coaches for instructions.**

The adjournment period offers an opportunity to map new plays; call new signals. This, if the course of legislation at the first session of the 84th Congress was to the liking of air-conditioning people, now is the time to say so. Or vice versa. Congressmen and Senators want to know constituents' wishes.

Matters pending:

• **Federal Aid to Education.** Representatives of most States are to meet at the White House November 28 to discuss surveys they have made of school needs. Already the House Education and Labor Committee has approved a **loan-grant-guarantee** bill involving some $8.3 billion in tax money. With school construction so important to air-conditioning and heating people, the question is "should such building be federally financed (and controlled)?" Your Senator wants to know.

• "Divide and conquer" was the successful strategy employed by those who raised **minimum wages** to $1 an hour by amending the Wage-Hour law. They postponed until the coming session the question of increased coverage. Some 24 million workers would be added to the covered lists by proposed legislation. Your views?

• **Natural gas** supply and price is involved in proposals to place independent gas producers under federal control. House has passed legislation to exempt. Issue will be before the Senate early in the second session. Signals?

• **Power Policies; Power Politics.** Whether tax-payers' money or private capital should develop and control power production will be a hard-fought issue in 1956 election campaigns.

• **Public Housing Again.** Exponents of public housing weren't content with the **45,000 units** authorized in the one year extension of such legislation. Some interests want no such housing; others will press for **135,000 units per year** for four years. Your views?

• **Highway Construction,** forerunner of suburban migration, has important overtones for air-conditioning, heating and ventilating folks. **How to pay** for needed highway expansion stymied all action in the first session, 84th Congress. Meanwhile, the delay is piling up a backlog of both highway and related construction. How do *you* prefer to pay for your new highways—out of general tax funds, or by increased levies on those who use the roadways? Your Congressman will have to know.

It will be interesting to watch how Congress handles hearings on two contrasting subjects—the **Hoover Commission Recommendations,** and proposals to **expand Social Security.**

• Hoover Commission recommendations suggest several hundred ways of saving money in government operation. One hundred and sixty-seven would **require legislation;** others could be put into effect through **administrative rulings.** How many of the 167 will Congress consider, and for how long?

• Social Security hearings, on the other hand, involve **billions of dollars and millions of votes.** Legislators are human; they'd like to know your views.

Further tax reductions, principally for individuals, will be noisily debated when Congress re-convenes. The subject is an election-year natural, unequalled as a vote-getter. Understandably, few voices will be raised in opposition to lower taxes and Congress will accept this silence as a mandate for lower levies. The thing to watch, however, is the **business tax schedule.** Unless signals change, the corporate tax rate is to drop to 47% (from 52), effective April 1, 1956.

(*Continued on page* 8)

The Invisible Enemy No.2

moves with incredible speed

In time of war it instantaneously devastates and obliterates with its searing heat, every human being within a tremendous radius, when released by a nuclear bomb. Though it has no temperature, its enormous energy changes into heat when it strikes and is absorbed by a surface.

Upon escaping from a building in winter, it leaves a chill behind. When it invades in summer, it takes its toll in excessive heat and human distress.

Its aliases are many—Infra-Red Rays, Heat Rays, Radiant Energy, Radiation.

It is responsible for 93% of the heat flow downward in summer through roof spaces; in wall spaces, for 65% to 80% of heat losses in winter, and heat flow inward in summer; for about 55% to 75% of heat loss upward in winter through ceiling and roof spaces.

Buildings are generally constructed with wall and ceiling air *spaces*, because the greatest flow of heat possible between two solids is by direct conduction—actual physical contact; and since air has low density, it allows little heat flow through it by conduction.

The enemy then becomes radiation in downward heat flow; and radiation and convection in upward and side heat flow.

A STALWART SHIELD

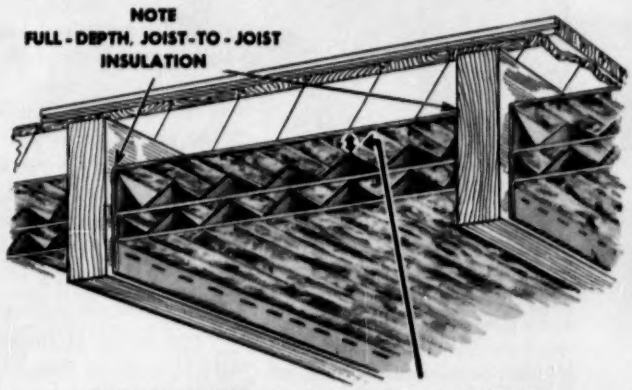
A shield against these enemies is multiple accordion aluminum. Its surfaces have an absorptivity to heat rays of a mere 3%; reflect them at the rate of 97%, and emit them at a rate of only 3%. Thus they retard the flow of heat rays outward or inward. Accordion aluminum is likewise a stalwart shield against the flow of heat by convection, its multiple layers of metal and fiber offering extremely effective resistance. Heat flow by conduction is minimized by its multiple layers of large air spaces, because they have slight density.

Scientifically separated sheets of aluminum, giving UNIFORM, full-depth protection to every inch of space between joists, will imprison the invisible enemy indoors in winter, prevent its invasion in summer, and transform it into a friendly and useful servant.

Its continuous metal sheets, up to 750 feet long, have almost zero permeability to water vapor. Infiltration under its flat, stapled flanges is slight. Its scientific construction minimizes condensation on or within this type of insulation.

More than 250 million square feet are in use today. For 10 years it has been repeatedly specified and used by many of the leading architects, engineers and builders of America.

Yours for the asking is a discussion of how and why aluminum insulates even under extreme conditions. It will be found in the booklet, "Thermal Test Coefficients of Aluminum Insulation for Buildings," published by the AMERICAN SOCIETY OF HEATING & AIR CONDITIONING ENGINEERS. Use the coupon for the literature and free samples of this scientific insulation.



NOTE FULL ONE-INCH EXTRA AIR SPACE above accordion pleats for even more resistance to heat flow. Each sheet extends from joist-to-joist.

COST OF EDGE-TO-EDGE INFRA
Multiple Aluminum Insulation installed in new construction between wood joists, material and labor

Type 6-PS about 10¢ sq. ft.
Type 4-PS about 8¢ sq. ft.

Infra Insulation, Inc., 525 B'way, N. Y., Dept. V-10
Please send ASHAE Booklet: "Thermal Test, etc."

Name_____

Firm_____

Address_____

WASHINGTON OVERTONES (*Continued from page 6*)

About Construction:

• Housing construction, after a brief lag in July, spurted ahead in August. Builders started construction on an estimated 123,000 new homes in August—8,000 more than in July—Labor Department statisticians reported.

• During the first eight months of 1955, a total of 928,000 **new dwelling units** were started. Comparable figures: 800,000 during first eight months of 1954; 992,000 during record 1950.

• Veterans Administration reported GI loan applications for August set a **five-year high** of 66,305.

• Despite **brakes on credit,** being applied by the government, Washington expects the building boom to go on up next year. Current estimate is $44 billion; about $2.3 billion or 6% above 1955. Private, non-residential construction will increase by 15%, with the private residential field continuing to account for about one-third of dollar expenditures.

• The Rains subcommittee of the House Banking Committee was scheduled to open a series of field hearings on October 5 to consider all phases of the housing situation. Hearings were scheduled for New York, Newark and Philadelphia, with others to follow. **Slum clearance programs** will top the list under study. Others: multi-family projects, mortgage credit availability, effect of recent restrictions on housing credit, operation of Federal National Mortgage Insurance Association (Fannie May), the Voluntary Home Mortgage Credit program, and housing facilities for the aged.

• New Regulations concerning heat losses determine whether a house can qualify for an FHA-insured loan. After a year's study of minimum property requirements, FHA has announced that houses must be so designed that the heat loss is no more than 55 Btu per square foot of floor space. During the war the **permissible heat loss** was reduced from 100 Btu to 60.

The announcement observes "this means a house must be more carefully designed and more tightly constructed to be eligible for FHA insurance. For example, windows and doors must almost necessarily be completely weatherstripped. Double glazing, storm windows and storm doors will be essential in colder areas. Primarily, however, ceilings and walls will have to be better insulated."

About Defense:

• No let-down in defense planning is signaled by a Defense Department announcement of a new series of **industrial planning conferences.** The confabs were to start in early October in San Francisco, proceed to Los Angeles, and continue in other areas having strategic defense facilities. Purpose: "to assure the infusion of more production know-how into industrial mobilization planning."

• Over a period of six years, **small business** received $6,740,000,000 of $32,958,000,000 in procurement contracts let by Navy. During this year, 73.8% of Navy's $3.9 billion purchases went to small business.

About Fuels:

• Construction of 4,900 miles of interstate **natural gas pipelines** was authorized during the year ended June 30, 1955, the Federal Power Commission reports. The pipelines are designed to add 1¾ billion cubic feet of daily delivery capacity to the nation's transmission systems.

• Operating revenues of 37 natural gas pipeline companies totaled $133,951,471 for **June, an increase of 21.7%** over the same month of 1954.

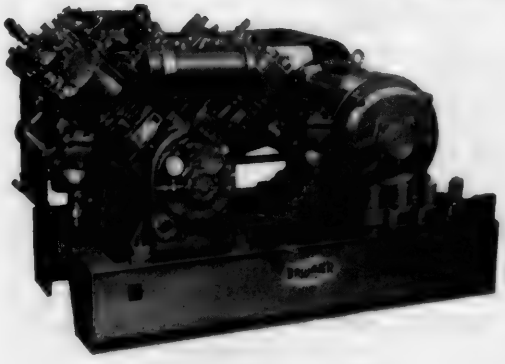
• The government has warned 18 oil companies to cut imports of crude and residual oil or face import controls. September 21 was set as the deadline for company suggestions on voluntary control.

About the Business Outlook:

• Industrial production established a new record of 140 above the 1947-49 base during August by rising one percent above July.

• Copies of the 339-page book of **Business Statistics, 1955** Biennial Edition, may be purchased for $2.00 from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Brunner planned it that way...



BRUNNER CONDENSING UNITS

. . . for remote air conditioning installation in commercial and industrial applications, are supplied in sizes up to 75 H.P. with capacity control. Brunner Compressor Units for use with evaporative condensers also available up to 75 H.P.

BRUNNER AIR CONDITIONERS

. . . completely self-contained, are available in various models up to 20 H.P. for residential or business installations. Easy to install, cost less to operate.

By choosing BRUNNER for dependable performance, thousands of users of Brunner Air Conditioners and Refrigeration Condensing Units have put their OK on Brunner quality.

This is not just a lucky coincidence . . . we planned it that way! Right at the beginning, we made up our minds that we were interested in producing only the best . . . and we've held to this objective for half a century.

Brunner "OK quality" is built into the product, step by step, from start to finish . . . pays off in finer performance, more years of trouble-free service, and lower operating costs. "SELL BRUNNER" with complete confidence that you are serving the best interests both of your customers and yourself.

Brunner offers a complete line of Refrigeration and Air Conditioning Condensing Units and Packaged Air Conditioners. See your Brunner representative, or write to:

BRUNNER MANUFACTURING COMPANY, Dept. K-1055, UTICA, N.Y.

The Brunner Co., Gainesville, Ga.

In Canada: Brunner Corp. (Canada) Limited, Toronto, Ontario

BRUNNER SINCE 1906

BRUNNER EXTRAS

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- Product Research
- Design Engineering
- Wide Product Range
- Proven Quality
- Complete Dependability
- Easy Servicing
- Warranted Performance
- Nearby Distributor Service
- Profit Opportunity
- Advertising Support
- Sales Promotion Help

BRIEFLY STATED

• The appointment of Harry Whittaker as assistant director of the research department of the Plumbing and Heating Division of American Radiator & Standard Sanitary Corp. has been announced. Dr. Whittaker comes to American-Standard from the United States Testing Co., Hoboken, New Jersey, where he served as engineering manager for the past year.

• Gustin-Bacon Manufacturing Company, Kansas City, Missouri, announces the appointment of F. W. Muller as manager, insulation sales department. H. M. Grant has been appointed assistant manager, insulation sales department, and S. E. Brelsford is assigned as assistant to the manager, insulation sales department. The new department merges the company's glass fiber snap-on pipe insulation and blanket insulation sales into one department.

• Two promotions have been announced at Worthington Corp.'s Air Conditioning and Refrigeration Division. William F. Bishop is appointed manager of national account sales and Robert C. Hughes appointed to manager of sales training. Mr. Bishop attended the Pratt Institute in Brooklyn where he studied architectural engineering. In 1939 he joined Worthington Corp. as manager of distribution in the Air Conditioning and Refrigeration Division. Mr. Hughes attended New York University and joined Worthington Corporation in 1953 as distributor supervisor in the Air Conditioning and Refrigeration Division.

• The firm of Seelye Stevenson Value & Knecht, New York consulting engineers, announces that Jack L. Staunton, chief sanitary, hydraulic and petroleum engineer, has been made an associate of the firm.

• Trion, Inc. of McKees Rocks, Pa. internationally known manufacturer of electronic air cleaners, has sold all rights to its Dill Dust-Spot Tester to the Research Appliance Co., also of the Pittsburgh district. The instrument was originally developed in the National Bureau of Standards under the direction of Richard S. Dill, chief of the Heating and Air Conditioning Section of the Bureau.

• Acquisition by the Walworth Company of the assets and business of the Southwest Fabricating & Welding Co., Inc., Houston, Texas, pipe fabricating company, was announced September 1. Walworth recently completed the acquisition of the M & H Valve and Fittings Co. a manufacturer of water works valves and fittings, as part of its expansion and diversification program.

• The stockholders of Hupp Corp. and Perfection Industries, Inc., in separate meetings August 29th, approved a plan to merge the two companies. At each meeting, the merger was favored by a majority in excess of 97%. Perfection thus will become the Perfection Industries Division of Hupp Corp.

• In conjunction with recently disclosed expansion plans, the Airtemp Division of Chrysler has announced the appointment of two new sales managers. H. Melvin Carnahan has been named sales manager in charge of residential air conditioning and heating; S. Anderson, Jr., sales manager in charge of commercial and industrial air conditioning. Mr. Carnahan who had held the post of assistant sales manager, residential air conditioning, joined Airtemp earlier this year. He was formerly vice president of sales of the Sunbeam Air Conditioner Division of the American Standard Co. of Pittsburgh. Mr. Anderson, who, until his present appointment, was assistant sales manager in charge of Airtemp's southern sales division, has been with Airtemp since 1943. He has in the past headed the company's Washington, Eastern and Atlanta sales regions.

• The General Electric Co. of Schenectady, N. Y., has become the one-hundredth Associate of Stanford Research Institute.

• Responding to increased public interest in air pollution problems, the Bureau of Mines has issued a new edition of the Ringelmann Smoke Chart, a standard guide often used in developing and enforcing smoke-control regulations.

• Novelty Steam Boiler Works, Inc., a subsidiary of Ellicott Machine Corp., Baltimore, Md., has completed the installation of a new department to be devoted to the application of tank linings. Inasmuch as the company is one of the larger producers of tanks and pressure vessels, it will afford purchasers the opportunity of securing tanks and linings from the same source. The types of linings to be applied include cement, rubber, plastisols, plastics, copper, lead, and metal clads.

• Donald R. Meckstroth has joined Westinghouse Electric Corp. as manager of marketing services for the company's air conditioning division at Staunton, Va. In this newly created position, Mr. Meckstroth will direct and coordinate all internal sales service, including advertising and promotion, market research, sales training and product service. He was formerly associated with Servel, Inc.

• Charles S. Leopold, Philadelphia Consulting Engineer since 1923, will be recipient of a Frank P. Brown Medal awarded by The Franklin Institute at its Annual Medal Day ceremonies, Wednesday, October 19. In making the announcement, Dr. Henry B. Allen, executive vice president, noted that Mr. Leopold is being cited in consideration of his outstanding contribution to air conditioning, particularly in the research and development of air conditioning techniques and the application of air conditioning to a wide variety of important structures.

• Total sales to ultimate consumers of the gas utility and pipeline industry during July, 1955, amounted to 4,124 million therms, equivalent to an increase of 4.2 percent over total sales of 3,959 million therms in July of last year. Sales of gas to industrial users were up approximately 5.2 percent. The AGA July index of utility and pipeline sales is 193.6 (1947-1949=100).

• The Air Conditioning & Refrigeration Exposition which will be held at the Atlantic City, N. J. Auditorium, Nov. 28 to Dec. 1, will be more than one-third larger than the last show. Exhibiting companies now total 232, with an expected 250 at the time of the opening. Displays will cover 88,000 square feet of net exhibit space.

What d'ya mean ...'saves 20%'!

proved
Actual bids are confirming this Nesbitt claim!
COMFORT AND PROTECTION INCREASED
SYSTEM COSTS REDUCED 20% OR MORE
Nesbitt
THE HEATING AND VENTILATING SYSTEM THAT SETS A NEW STANDARD OF CLASSROOM COMFORT

All right, Mr. Contractor, you've read our claim that with the Nesbitt Series Hot Water Wind-o-line System of heating and ventilating, a school can save 20 per cent or more of the construction, equipment, and installation costs entailed by the conventional system with trenches and runouts —and you ask "How come?" Here's how:

1. In the *series system* the Wind-o-line piping is the supply and return for the unit ventilators, eliminating costly pipe trenches, mains, runouts, and pipe covering. *Saves on construction.*

2. Water temperature is related directly to outdoor temperatures; heating capacity is assured with one-half to one-third the water; smaller pipes and pumps are used. *Saves on equipment.*

3. With smaller, shorter, simpler pipes and mains, and difficult piping factory-assembled within the Syncretizer unit ventilators, labor costs at the site are reduced. *Saves on installation.*

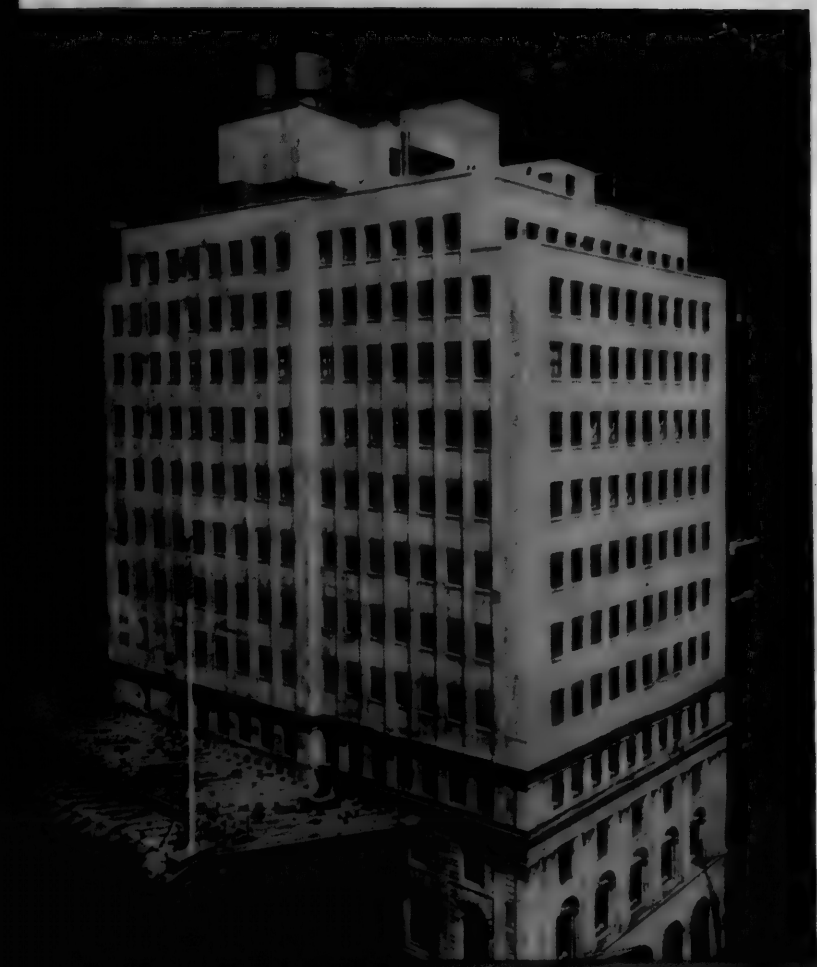
A school can SAVE, yet can HAVE the last word in thermal comfort

Groups of classrooms or entire wings are arranged in series-loop circuits. The copper tubing of the Wind-o-line radiation is the only required supply and return piping for the Syncretizer ventilating units. System water temperature is maintained in direct relation to outdoor temperatures: the Syncretizer control of room temperatures is improved; Wind-o-line protection against window downdraft and bodily heat loss is always related to actual needs. Without other investment, this equipment maintains safe overnight building temperatures. The whole amazing story is told in Publication 104.

Nesbitt SERIES WIND-O-LINE SYSTEM

Made and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa. • Sold also by American Blower Corporation

TUTTLE High



Seaman's Bank for Savings . . .
First entire building in New York City to use *double duct mixing plenum high pressure system* features complete flexibility of heating/cooling zone control.

Architects: *Halsey, McCormack & Helmer*
Consulting Engineer: *Edward E. Ashley*
General Contractor: *William L. Crow Construction Co.*
Air Conditioning Contractor: *Alvord & Swift*

Photograph taken during construction of Seaman's Bank for Savings showing installation of Tuttle & Bailey Type MPW Double Duct Mixing Plenum Wall Units.

Typical view of a general office area in Seaman's Bank for Savings showing how Tuttle & Bailey Type MPW Units blend with modern architectural design and decorative scheme.

ENGINEERED PRODUCTS FOR AIR CONDITIONING,

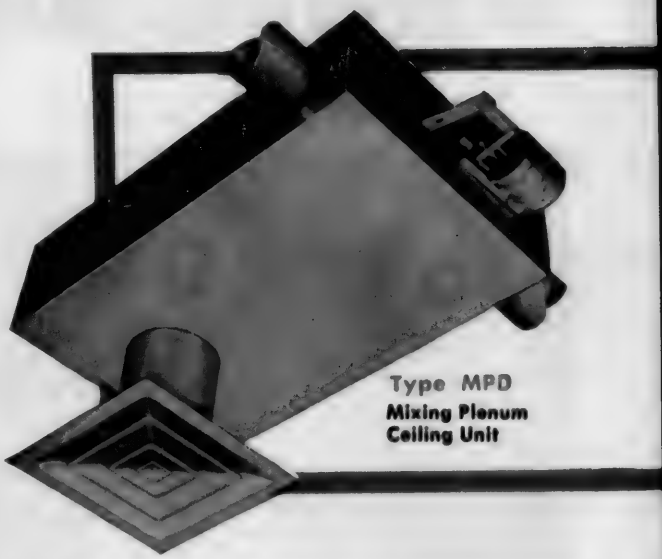
& BAILEY Pressure Units

give **SEAMAN'S BANK** for **SAVINGS**

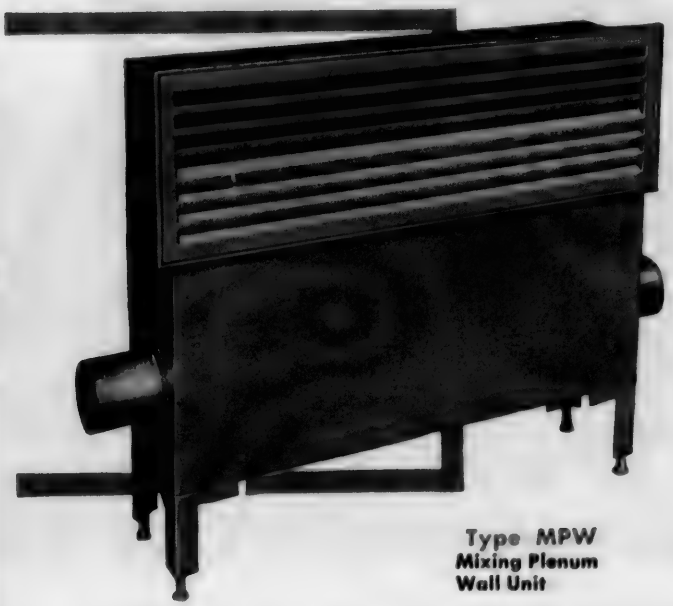
indoor weather that satisfies everybody!

IN THIS modern twelve-story addition to Manhattan's financial district, Tuttle & Bailey High Pressure Units will provide efficient, economical year-around heating and cooling comfort . . . Type MPW Wall Units are located under all windows throughout the building, in banking areas and private offices . . . Type MPD Ceiling Units are installed in the dining areas.

Operating on an all-air system, these double duct units mix and discharge varying proportions of heated and cooled air to provide a constant volume at the exact temperature desired in individual areas. This flexibility means one area can be heated while another is cooled regardless of time of day or season.



Type MPD
Mixing Plenum
Ceiling Unit



Type MPW
Mixing Plenum
Wall Unit

Savings in overall building and installation costs were effected by the use of conduit risers and branches which reduced floor-to-floor dimensions . . . a single primary equipment room resulted in more useable space . . . and the need for supplementary equipment required for the operation of other types of systems was eliminated. In addition, utilization of 100% outside air for cooling when temperature permits will save the cost of operating compressors, pumps, and cooling tower during such periods.

For complete information on the advantages of a high pressure air distribution system in new construction — or for remodeling — get in touch with your nearest Tuttle & Bailey Representative or write for Catalog No. 109 and Bulletin No. 110.

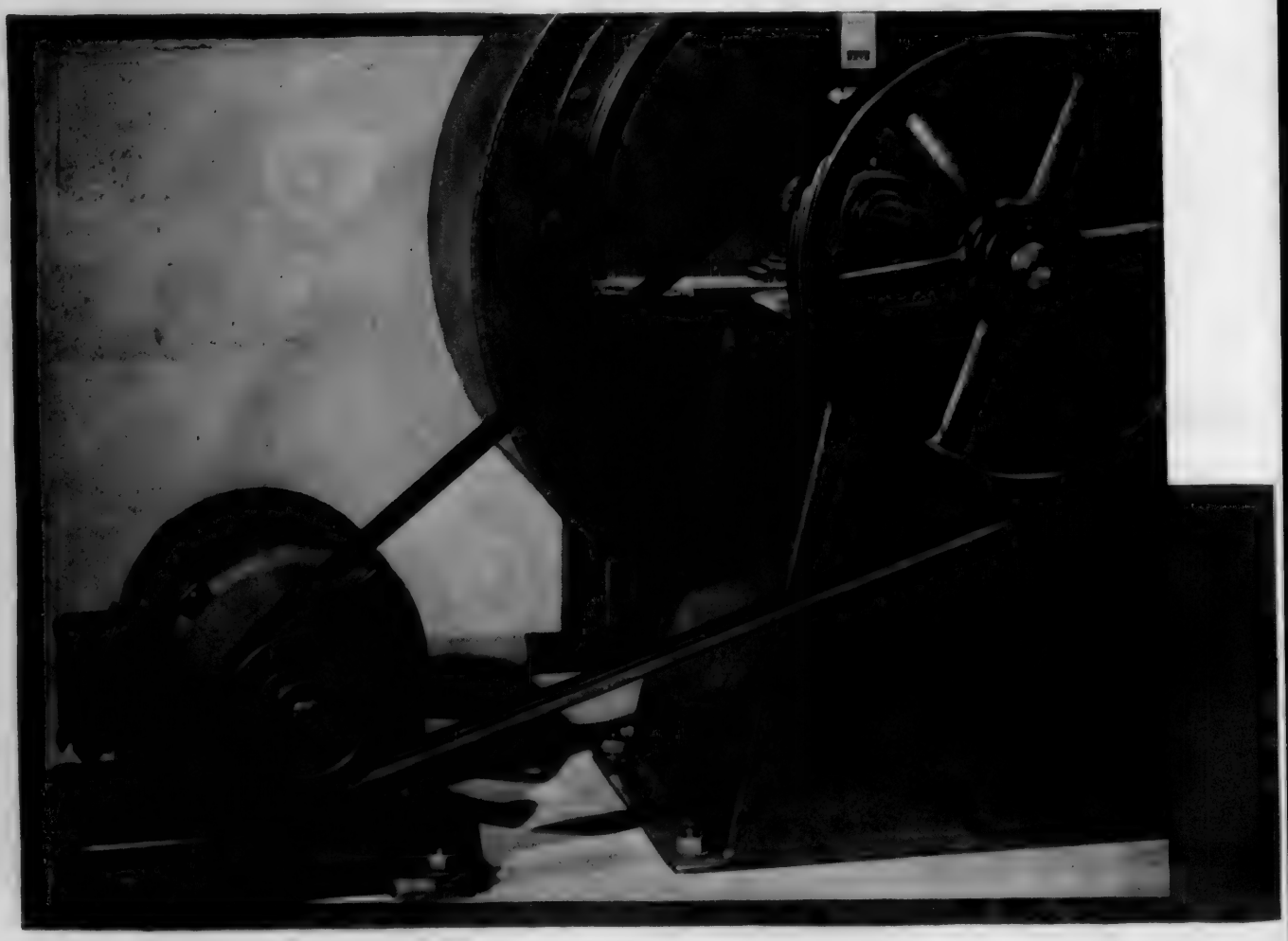
TUTTLE & BAILEY inc

NEW BRITAIN, CONN.

VENTILATING AND HEATING

Control-Motor-Drive

Save Engineering



ALLIS-

...Simplify Service

These Components are Designed to Work Together and They're Backed by Nation-Wide Service

Cut Engineering Time and Cost. Select all components for your complete drive... motor, control and *Texrope* V-belt drive... from one source. All ratings are coordinated to make selection easier. Parts match up properly.

Reduce Installation Costs. Parts fit together easily at assembly because they are designed and built to be used together... to fit a single set of standards. And, of course, you have one responsibility for the performance of the complete drive unit... one reliable guarantee of satisfaction.

Get Nation-Wide Service. Allis-Chalmers continues to serve you and your customers after your equipment is installed. In addition to 76 district offices, there are almost one hundred Certified Service Shops located in every industrial area in the country. These shops are carefully selected, independent shops that use only factory-approved parts and methods in servicing Allis-Chalmers equipment.

For an experienced specialist to help you select the best drive for your installation... for coordinated equipment... call your nearby Allis-Chalmers District Office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4691

Send for FREE engineering literature

Control

Handy Guide to Starters	14B7733
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Texrope Drives

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CHALMERS

Texrope is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

illinois

FLOAT AND THERMOSTATIC TRAPS

SERIES G • FOR LOW PRESSURE STEAM SERVICE

Recommended Applications . . .
Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Process Heaters, Hot Water Generators, Drips of Mains and Risers.

Illinois Float and Thermostatic traps operate under vacuum with the same high efficiency as under pressure. No more water-logging in mains...no more air pockets...put an end to "morning overload" troubles. The condensate control valve provides complete and instantaneous drainage of condensate while a separate thermostatically controlled valve in cover vents air in large volume, yet prevents loss of valuable steam.

The condensate valve is actuated by impact when the float drops—a snap action that is independent of the rate of flow of the condensate. Valve is not directly attached to the float and is either tightly closed or wide open. This instantaneous operation makes wire drawing impossible.

Illinois traps, because of their unique valve action, function perfectly at all load conditions, with lower return line temperatures than ordinary type traps. Lower return line temperatures assure higher vacuum pump efficiency. Straight through connections save head room, fittings, labor. Trap is easily opened for inspection. It is not damaged by freezing. Sizes from ¾ inch to 2 inches.

Write for Bulletin

ILLINOIS ENGINEERING COMPANY

illinois ENGINEERING

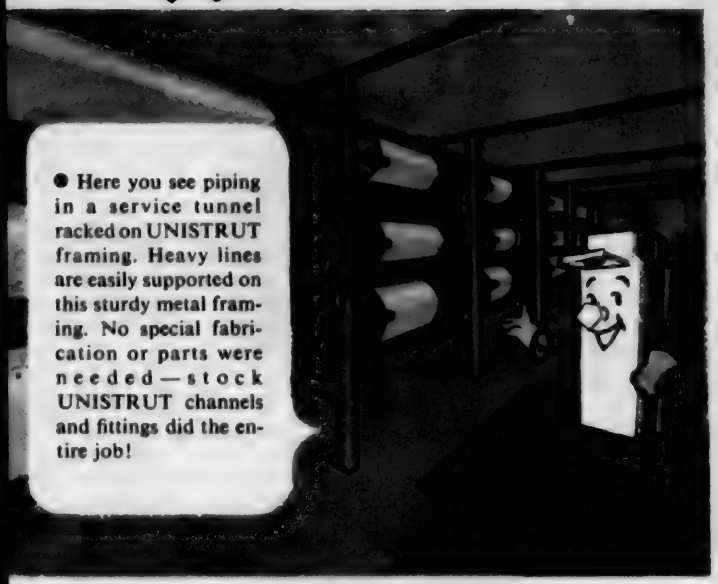
2045 SOUTH RACINE AVENUE • CHICAGO 8, ILLINOIS

DIVISION OF AMERICAN AIR FILTER COMPANY, INC.

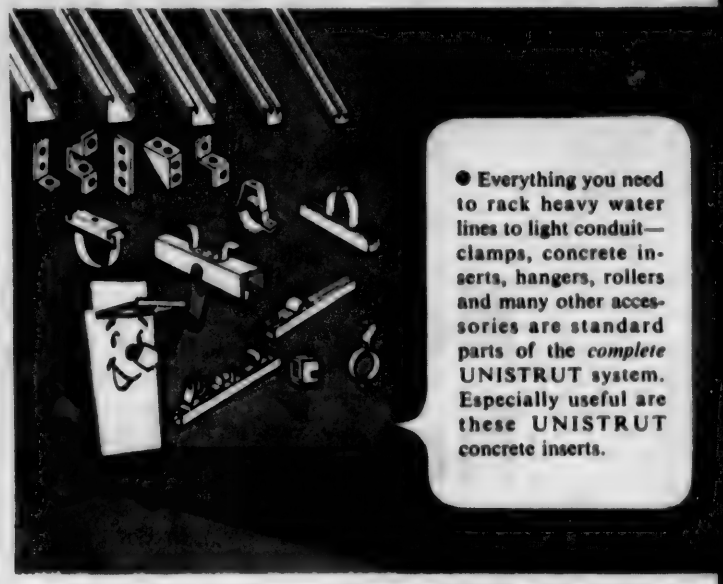
The Sky's The Limit

—when you build with UNISTRUT®

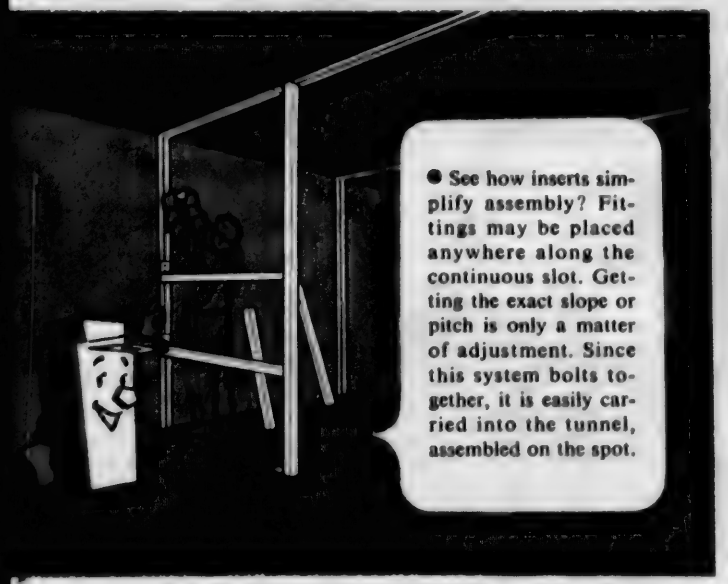
Mr. Strut simplifies pipe racking with cost-cutting UNISTRUT framing



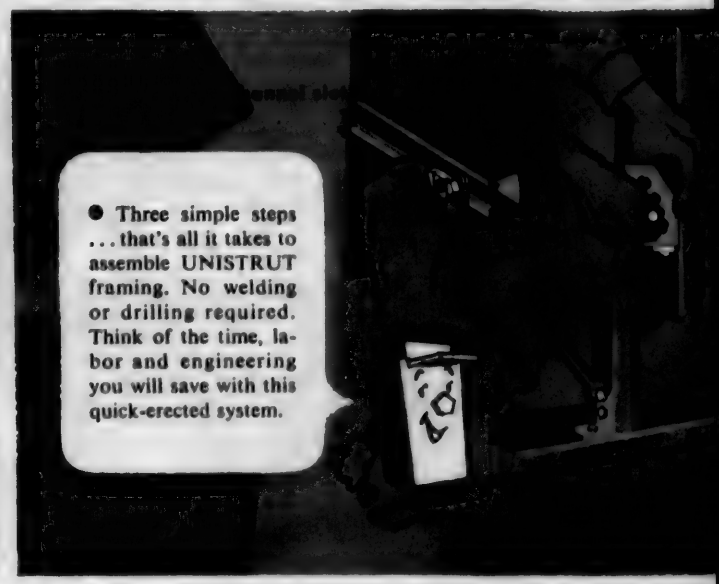
● Here you see piping in a service tunnel racked on UNISTRUT framing. Heavy lines are easily supported on this sturdy metal framing. No special fabrication or parts were needed—stock UNISTRUT channels and fittings did the entire job!



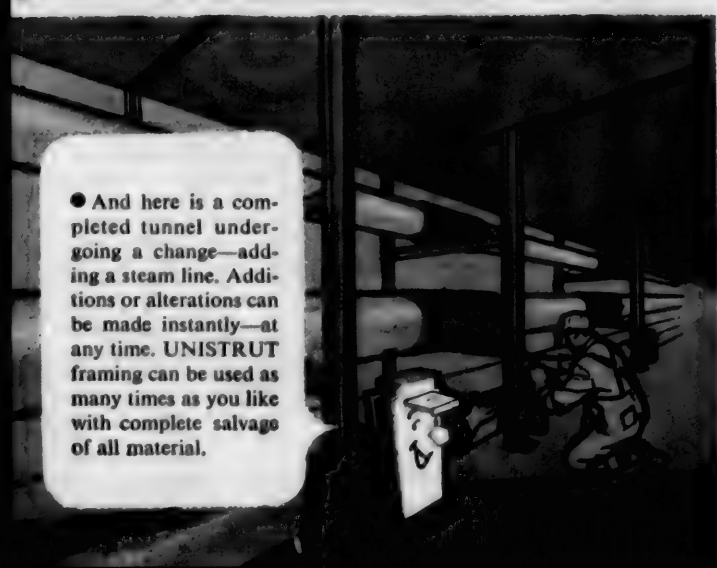
● Everything you need to rack heavy water lines to light conduit—clamps, concrete inserts, hangers, rollers and many other accessories are standard parts of the *complete* UNISTRUT system. Especially useful are these UNISTRUT concrete inserts.



● See how inserts simplify assembly? Fittings may be placed anywhere along the continuous slot. Getting the exact slope or pitch is only a matter of adjustment. Since this system bolts together, it is easily carried into the tunnel, assembled on the spot.

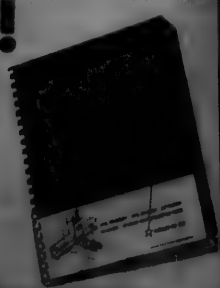


● Three simple steps . . . that's all it takes to assemble UNISTRUT framing. No welding or drilling required. Think of the time, labor and engineering you will save with this quick-erected system.



● And here is a completed tunnel undergoing a change—adding a steam line. Additions or alterations can be made instantly—at any time. UNISTRUT framing can be used as many times as you like with complete salvage of all material.

Free Catalog!



Send today for your free copy of the 78-page catalog No. 700. Shows countless examples of how to rack, frame, suspend and support all kinds of mechanical and electrical equipment.

U. S. Patent Numbers

2327587 2541908 2329815 2345690
2363582 2696159 2380579 2409681
Other patents pending

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Please send without obligation items checked below:

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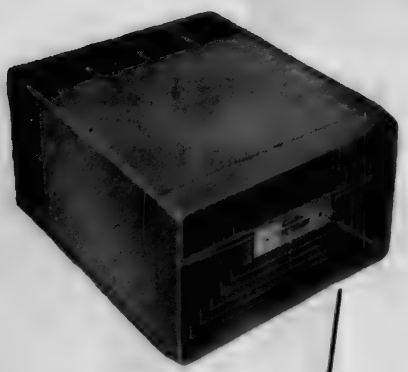


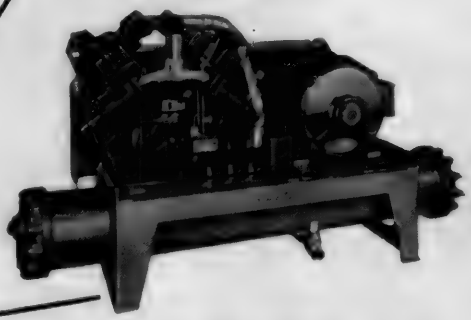
Window Air Conditioners

Packaged Air Conditioning units—2 to 20 tons

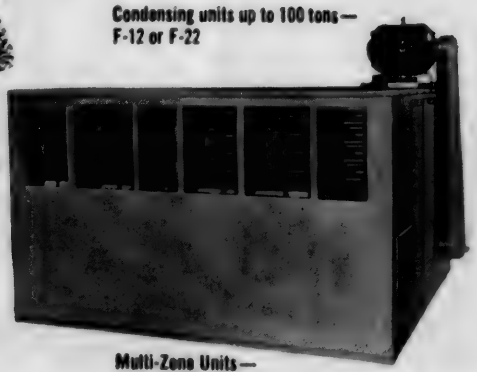
More jobs... More profit!

WITH THIS

complete Curtis LINE

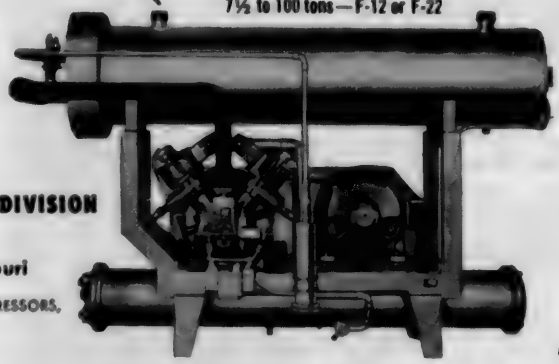


Condensing units up to 100 tons—F-12 or F-22



Multi-Zone Units—serving 2 to 8 zones

Packaged Liquid Chillers—7½ to 100 tons—F-12 or F-22



You'll sell more jobs, and make more profit, with this well-rounded Curtis line. Curtis equipment sells readily because it is backed by one of the oldest and most respected names in the business. Curtis products are presold for you by hard-hitting national advertising in *Saturday Evening Post, Time* and *Newsweek*, plus many national business and trade magazines.

WRITE TODAY for information on how you can obtain a Curtis direct factory franchise.

Curtis REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
1999 Kienlen Avenue, St. Louis 20, Missouri

Other Curtis Products: INDUSTRIAL AND AUTOMOTIVE AIR COMPRESSORS, AUTO LIFTS, CAR WASHERS, AIR HOISTS

829-

No shut-down shudders here!

As the letter opposite makes clear, the McDonnell Pump Control, illustrated below, is handling a mighty important job in the big, modern Skokie plant of Felt Products Mfg. Co.

Its task is to maintain an adequate water level in the fast-steaming Mears-Kane-O'Feldt Boiler on which it is installed. This boiler supplies process steam at pressures up to 200 psi. to molds used for pressing gaskets . . . so a boiler failure could be ruinous to gasket production.

This is the kind of job the new McDonnell No. 92 Pump Control, Low Water Cut-off and Alarm was built to do — the kind of job it is doing supremely well as brought out in the letter from Mr. Turner of Felt Products Mfg. Co.

Never forget that low water strikes its deadly blows without warning. So only the best boiler water level control is good enough to safeguard *your* boiler. In the new McDonnell 92 Series you have the best that care and experience can produce for higher pressure applications like this . . . and there is a McDonnell control for every application and pressure up to 250 psi. Read the facts about the new 92 Series and ask for bulletin L-119 that tells the entire story.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

FELT PRODUCTS MANUFACTURING COMPANY

Skokie, Ill.
Aug. 12, 1955

McDonnell & Miller, Inc.
3500 N. Spaulding Ave.
Chicago 18, Ill.

Attention: Mr. Fred Rohe

Dear Mr. Rohe:

We are highly pleased with the positive operation of your McDonnell No. 92 Hi-Pressure Controller on our Mears-Kane-O'Feldt Boiler.

As you know, the continuous operation of this boiler is vital to our manufacturing operations as the live steam from it, up to 200 psi., is used to heat molds for pressing gaskets which we make.

Your controller appears to be all that can be asked for in quality and advanced design. We believe it is as fool proof and service free as a piece of equipment can be.

We also appreciate your care in checking our requirements and making sure the controller is correctly installed and giving good service.

Sincerely,

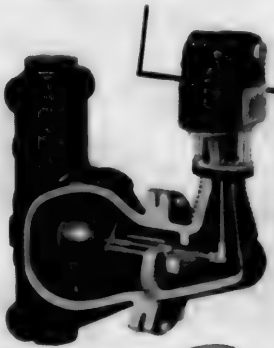
Hiram F. Turner

Hiram F. Turner

New product of "Doing One Thing Well"

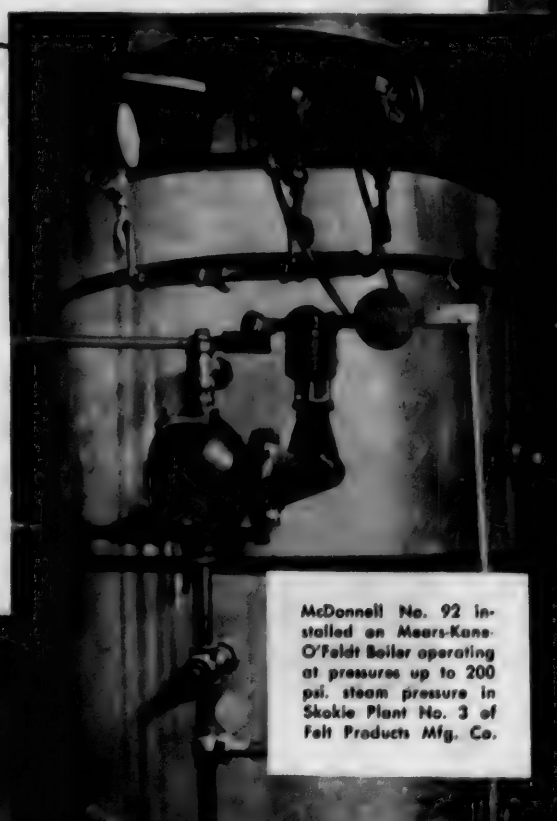
A pump control, low water cut-off and alarm for steam pressures up to 250 lbs.

Out of long experience with Alnico magnets as applied to electrical switches has come a new principle in magnetic switching used for the first time in the McDonnell No. 92 Pump Control, Low Water Fuel Cut-off and Low Water Alarm. Unlike other magnetic switches, those used in the No. 92 series operate on *repulsion — not attraction* — giving a powerful and positive action in both opening and closing.



Your Jobber Stocks Them

This new principle is found in a control that has been designed throughout to provide a new measure of dependability. Notice the generous float chamber and deep sediment chamber . . . little possibility of interference with float operation here! Float arm fulcrums on flat Beryllium springs assuring accurate alignment and minimum friction—another advancement. A typical refinement is a "Teflon" sleeve on the coupling to the switch rod. "Teflon" is made to order for this difficult assignment. Remarkable dissipation of heat is accomplished between float chamber and switches. The drop (to 167°F.) complies with *current* Underwriters' standards — a remarkable accomplishment. The control is also made with integral water column (No. 192) which cuts installation costs. Ask for data showing how easily and economically this control can be applied to your boiler.



McDonnell No. 92 installed on Mears-Kane-O'Feldt Boiler operating at pressures up to 200 psi. steam pressure in Skokie Plant No. 3 of Felt Products Mfg. Co.

McDONNELL

WHY Worthington rates so

UNUSUAL DESIGN

Completely sheathed in glass, the new Manufacturers Trust Building in New York posed an unusual air conditioning problem. The job is taken in stride by a modern Worthington central station system consisting of two 150-ton packaged water chillers.

HEAVY TRAFFIC

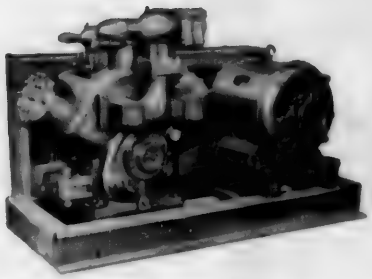
Keeping more than 12,000 people cool daily at New York City's new airlines terminal is a tough job. It's handled by a 315-ton Worthington centrifugal refrigeration system, together with Worthington air handling equipment and pumps.

HUMID HEAT

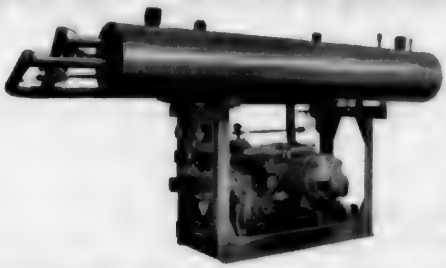
The Sterling, Miami Beach's newest oceanfront hotel, has *everything* but humid heat! An all-Worthington air conditioning system cools 142 rooms and 186,000 cubic feet of dining room and lobby space. Basic unit is a 60-ton Worthington "million-dollar" Freon compressor. Worthington packaged units are also spotted at key points.

many key air conditioning jobs

There are good reasons why unusual design, traffic or climate conditions can't trip up a Worthington dealer. He handles the most complete line of central station equipment in the industry. And, he's backed by Worthington's 70 years of specialized air conditioning experience. With assets like these, he's ready to take on *any* air conditioning job! For more details about the complete line, write Worthington Corporation, Air Conditioning and Refrigeration Division, Sect. A.5.57-V, Harrison, New Jersey.

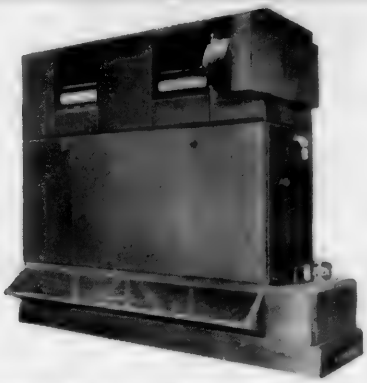


NEW FREON COMPRESSOR. Marked by sturdy construction and higher operating speeds, the new Freon compressor line ranges from 3-150 hp. Scientific balancing of rotating and reciprocating elements assures quiet, vibration-free operation.

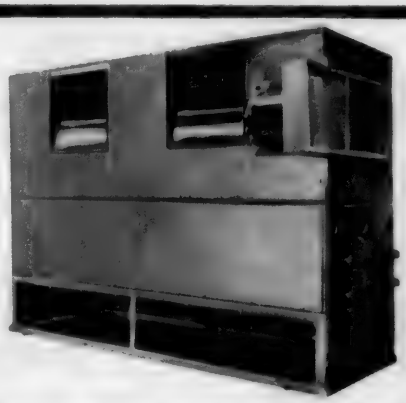


COMPACT LIQUID CHILLERS, in sizes up to 200 hp, provide dependable air conditioning where chilled water is used as the cooling medium. Factory assembled units show trim design; require minimum floor space. "Hearts" of these units are Worthington Freon Compressors.

INDUCTION CIRCULATOR. Room air conditioning unit operating on high-pressure air induction principle. Used for perimeter cooling and heating of multi-story buildings. Absence of moving parts means long life, quiet operation. 75 to 1000 CFM total air distribution.



EVAPORATIVE UNITS are designed for application where water is high in cost or temperature. Units reduce water consumption by 90% or more; do not require cooling towers. Can be adapted for indoor or outdoor use. Six sizes range from 10 to 150 tons.

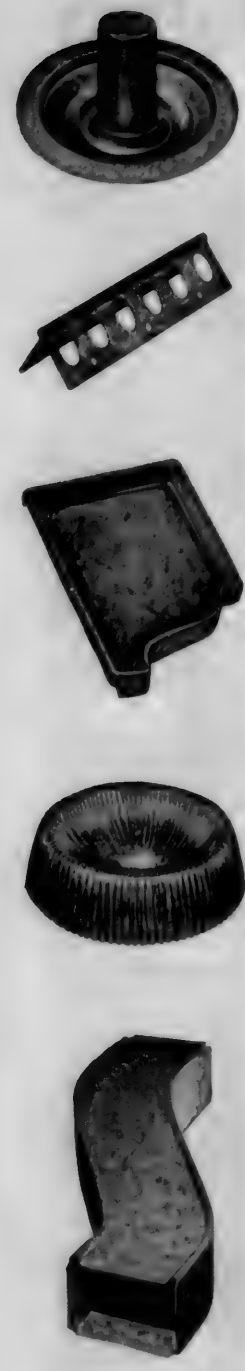


AIR HANDLING UNITS for remote air conditioning. Cooling coils available for direct expansion Freon-12, Freon-22, or chilled water. Floor and ceiling mounted units are functionally designed for easy installation and operation. 1,400 to 13,500 CFM.

A.5.57-V

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME



A CHALLENGE!

THE STRONGEST MADE BY ANY GALVANIZED SHEET:

Anything that

If you've been having difficulty fabricating galvanized sheets, try Wheeling SOFTITE Galvanized Sheets.

Here are sheets you can work to the limits of the base metal . . . so ductile, so tight-coated, you can use them for anything you make of steel sheets.

Bead it, draw it, seam it . . . you name the operation . . . Wheeling SOFTITE will take it and come back for more . . . with never a trace of chipping or flaking of coating. And for good reason – SOFTITE *has the tightest zinc coating yet produced.*

Put SOFTITE to the test. See for yourself why the demand for SOFTITE has forced Wheeling to triple its production facilities in 1955.

Galvanized steel does it better . . . SOFTITE *does it best!*
Send for full information today. Call or write the Wheeling sales office nearest you.

IT'S WHEELING STEEL

can be made of steel sheets

can be made of

WHEELING

SOFTITE®

galvanized sheets!

WHEELING STEEL CORPORATION

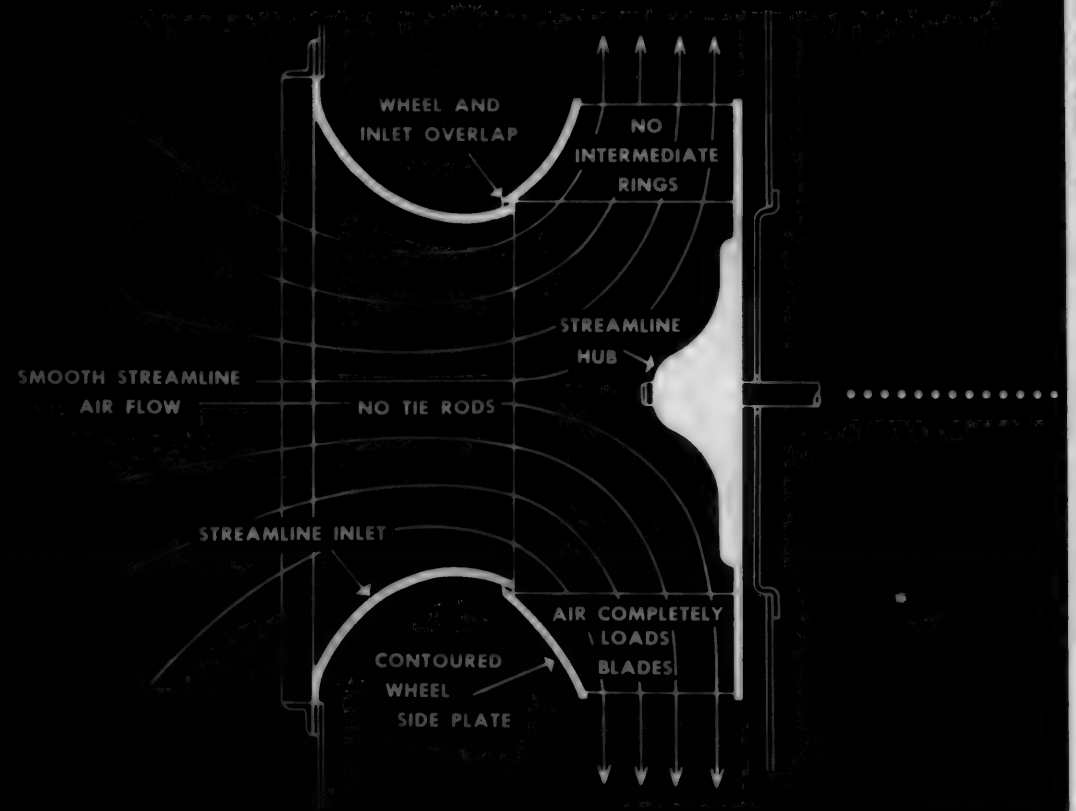
WHEELING, WEST VIRGINIA

District Sales Offices

ATLANTA	BOSTON	BUFFALO	CHICAGO	CINCINNATI	CLEVELAND
DETROIT	HOUSTON	NEW YORK	PHILADELPHIA	ST. LOUIS	SAN FRANCISCO

Fact:

Westinghouse Aerodynamic Fan Line More Efficient,



MECHANICAL EFFICIENCY 86%...
STATIC EFFICIENCY OVER 80%

With unobstructed airflow through the wheel in all sizes, the "Silentvane" fan line also offers these other practical advantages:

1. **True self-limiting horsepower characteristic**
2. **Peak horsepower developed in normal selection range**
3. **Quiet, stable operation**
4. **Sharply rising pressure characteristic throughout normal performance range**

WIDE RANGE OF APPLICATION

Handling from 600 to 500,000 cfm, the performance-proved Westinghouse "Silentvane" fan line provides an almost unlimited choice of air moving equipment. Coupled with Westinghouse-Sturtevant power-saving Vane Control, "Silentvane" fans offer precise control of air volume at optimum efficiencies. In smaller sizes, 36" and under, fan arrangements are convertible.

Research Makes "Silentvane" Quiet, Non-Overloading

AIRFOIL BLADING AVAILABLE

. . . where quiet operation and power evaluation are prime considerations—
65% less noise intensity . . .
92% mechanical efficiency.

MORE FACTS?

Call your nearest Westinghouse-Sturtevant Sales Engineer . . . he's the "Man with the Facts" on heating, air handling, and electronic air cleaning . . . or fill in the coupon below.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE . . . IF IT'S

J-90497

Westinghouse

Westinghouse Electric Corp.
Sturtevant Division, Dept. 6K
Hyde Park, Boston 6, Mass.

I'm interested in your new booklet. Send me a copy right away.

NAME AND TITLE.....

COMPANY.....

CITY.....STATE.....

GENERAL ELECTRIC ANNOUNCES

CEILING-MOUNTED PACKAGED AIR CONDITIONERS

All-in-one unit needs no floor space... gives important design advantages

These compact G-E units enable you to plan more efficient use of space. They don't use a foot of floor space—instead, are attached to the ceiling or mounted on a shelf. And they're compact, self-contained packages—with motor, compressor and condenser all sealed inside the unit.

Air-Cooled or Water-Cooled

Where water is a serious problem, G-E air-cooled units, in 3 and 5 ton sizes, are an ideal answer... use no water, require only air and electricity. G-E water-cooled units are available in 3, 5 and 7½ ton sizes. All units may be equipped with coils for winter heating.

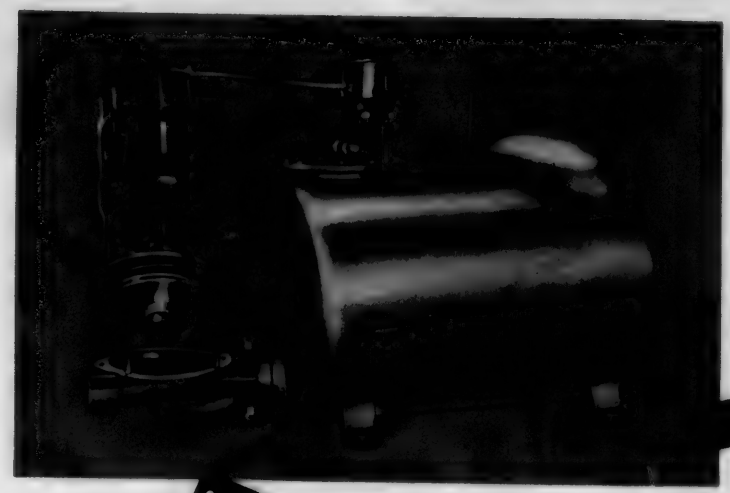
Only complete packaged air conditioning line on the market—fills every need

Now, you can specify from one manufacturer the right air conditioning units to fit your plans. G-E floor-mounted models—in 3 to 15 ton capacities—are as well suited for modern functional design as G-E ceiling-mounted packages. For free booklet, "What Every Businessman Should Know About Weather Reflex", write General Electric Company, Commercial and Industrial Air Conditioning Department, Bloomfield, New Jersey.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Let's look into a SKIDMORE



TYPE "VC" CONDENSATION PUMP

• • • QUIET OPERATION

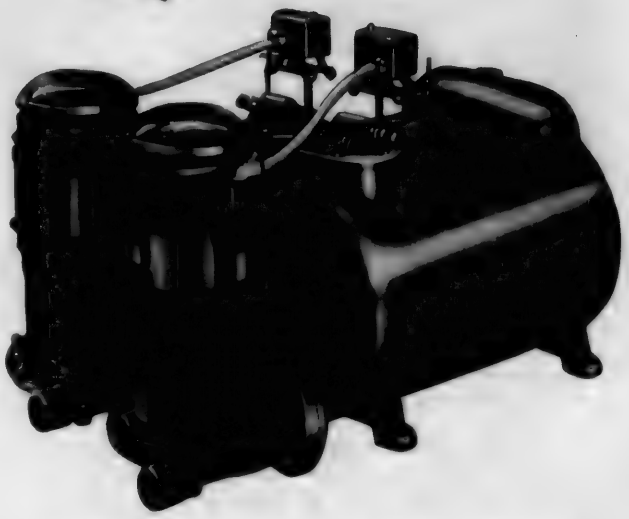
• • • LOW INLET CONNECTION

• • • STURDY CAST IRON

• • • ACCESSIBILITY WITHOUT DISTURBING PIPING

Contractors, engineers, architects—men who specify heating pumps, look to Skidmore for a dependable source. They know that in every Skidmore Pump is built years of service and dependability . . . they know that from past experience Skidmore has just the type and capacity for their job, regardless of installation requirements.

Add to this, the practically service-free performance—the sturdy balanced construction. Yes, look into a Skidmore Pump, and then you can see why Skidmore has been synonymous with quality pump engineering since 1921.



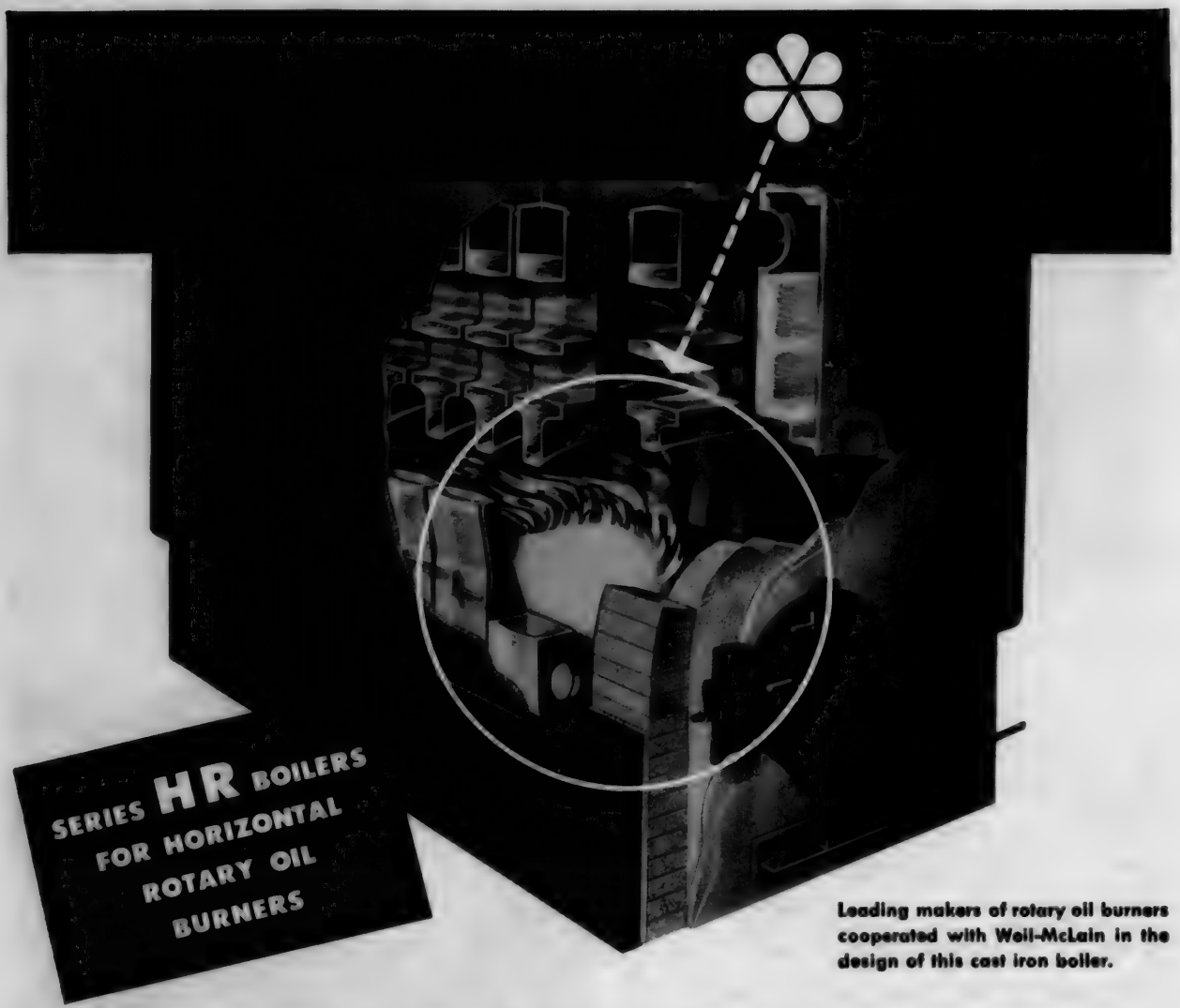
Type "VC" Condensate Pump (duplex unit shown above) is perfectly balanced to assure quiet, smooth operation.

Capacities range from 1,000 to 65,000 sq. ft. E.D. R. Discharge pressures from 10 to 75 lbs.

Write for Bulletin No. 10-B—describes fully the type "VC" Pump

SKIDMORE PUMPS

SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN



Leading makers of rotary oil burners cooperated with Weil-McLain in the design of this cast iron boiler.

Within the circle above, you'll find the features which make the Weil-McLain HR Series Boiler a revolutionary advance in heavy oil burning efficiency.

Note first the fire box. Its extra large combustion volume assures lower heat release per cubic foot... maximum radiant heat transfer...higher CO_2...and more complete, smoke-free combustion. Large waterways permit rapid, efficient water circulation through the boiler.

The heavy steel front plate is a special feature which greatly simplifies burner installation. It is furnished blank with a scribed center line for easy location of the various openings required. Or, if requested, the factory will furnish the plate drilled and tapped to specification.

HR Series Boilers have sturdy steel, green enamelled jackets lined with heavy density fibre glass...saves insulating time on the job.

This boiler is built of rugged *cast iron*—strongly resistant to the corrosive effects of the large sulphur content of heavy oils. Its sectional construction and short individual draw rods assure easier erection and a more flexible assembly. Note, too, the high base—it eliminates a high brick foundation.

WEIL-McLAIN

For complete information, send for Bulletin No. C-188

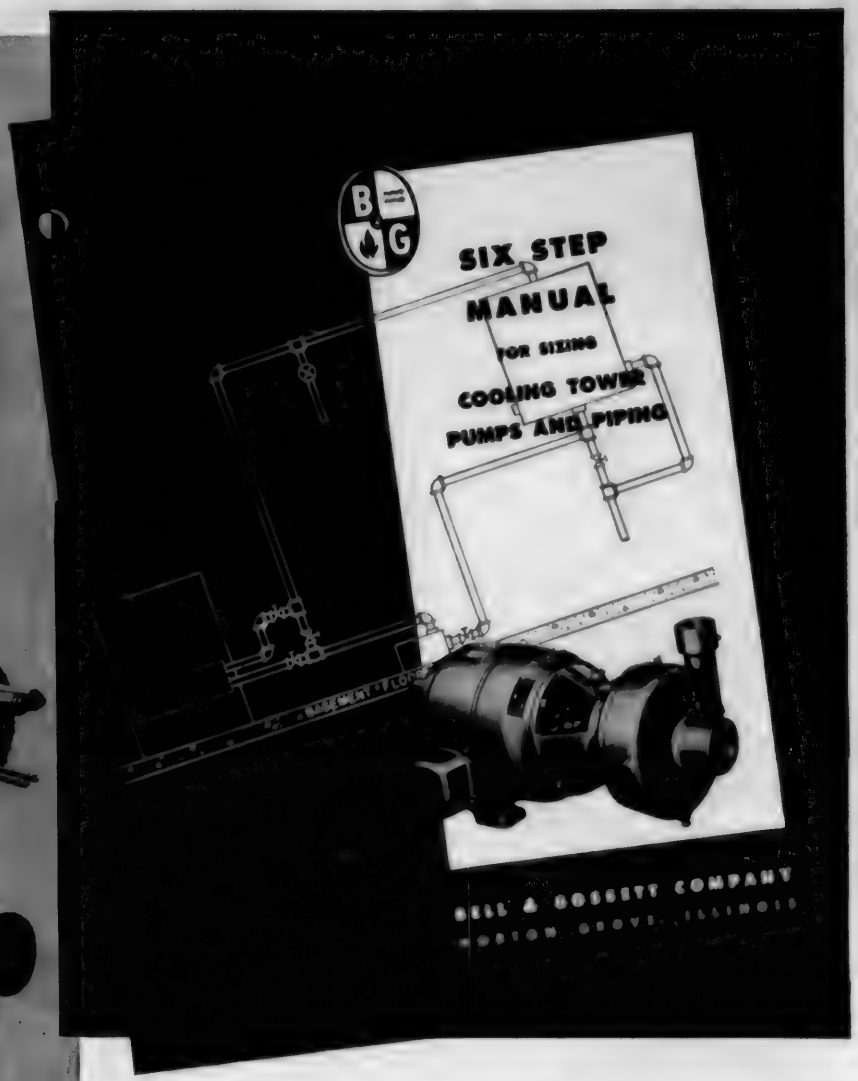
WEIL-McLAIN
BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. BH-105

NEW B&G DESIGN MANUAL

SHOWS HOW TO CORRECTLY DESIGN COOLING TOWER SYSTEMS



This authoritative Manual fills a long-felt need in the air conditioning and refrigeration industry! It enables you to quickly and accurately size the pump and piping for any cooling tower application.

In six simple steps the procedure is given for determining the flow rate required—the static head and pressure drop through the system—sizing the pump—and for a final check to be sure that the most efficient and economical selections have been made. A method of sizing pipes for gravity flow is also outlined in the Manual.

Easily read tables and charts shorten designing time. A handy work sheet is included which lists all calculations in correct sequence and prevents possible errors.

Every designer of refrigeration and air conditioning systems will find the B & G Manual an invaluable aid.

FREE! Send to Bell & Gossett Co. for your copy of the B & G Six Step Manual for designing cooling tower systems.

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COMPANY
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Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada

eliminates air conditioning problems when relocating partitions...

multi-vent®

LOW VELOCITY AIR DIFFUSERS

For architects and engineers designing air conditioned modular office space, Multi-Vent solves a troublesome problem. Multi-Vent air diffusing panels, once installed flush in the ceiling, need not be moved, altered in any way, or even adjusted when partitions are moved to suit tenants' changing needs.

Since Multi-Vent introduces conditioned air through the perforations in standard acoustical ceiling pans at low velocity, and since the air is gently diffused downward into the room, there is no "throw" or "blow" to bounce off nearby partitions. It is for this reason that a partition may actually bisect a Multi-Vent panel without affecting comfort conditions in the surrounding area.

Write for detailed literature and name of representative in your area.

multi-vent division of THE PYLE-NATIONAL COMPANY

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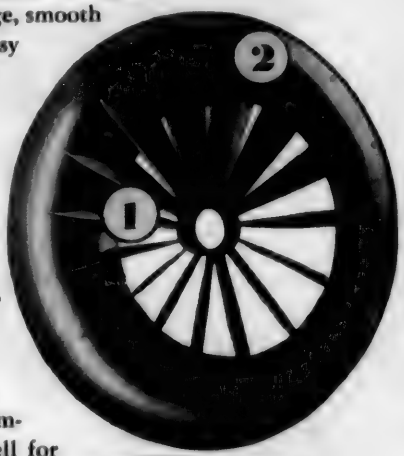
SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA

Double Check EVERY FEATURE!

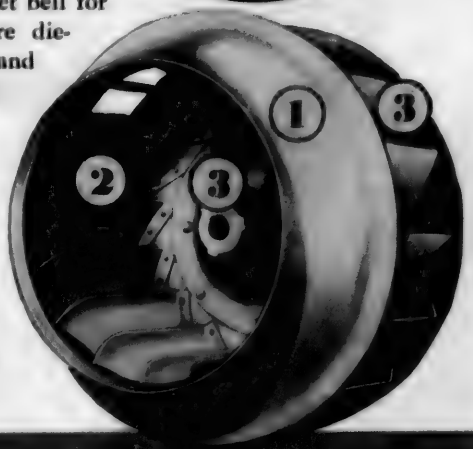
"Buffalo" Type "BL" Limit-Load VENTILATING FAN—This photo shows three of the unique features in the "BL" Fan which are giving users more for their money: (1) properly proportioned housing, streamlined for peak efficiency; (2) "Buffalo" self-aligning bearings (choice of sleeve or anti-friction type) for easiest maintenance and longest life; and (3) large, smooth inlet collar for easy duct connection.



FREE-FLOW INLET

Note "Buffalo" inlet guide vanes (1) which assure full rated delivery with minimum turbulence even when inlet conditions are unfavorable. Inlet losses are further reduced by the smooth, die-formed inlet bell (2) which matches the wheel shroud.

ROTOR FEATURES — At right, note the unusual rotor design which has made for exceptional stability and efficiency of performance. (1) Shroud is die-formed to full curvature to match inlet bell for proper air flow in wheel. (2) Backward-curved blades are die-stamped, welded and riveted for maximum strength — and insure stable air flow. (3) The heavy-gauge back plate and extra-heavy hub provide strength where it's needed.



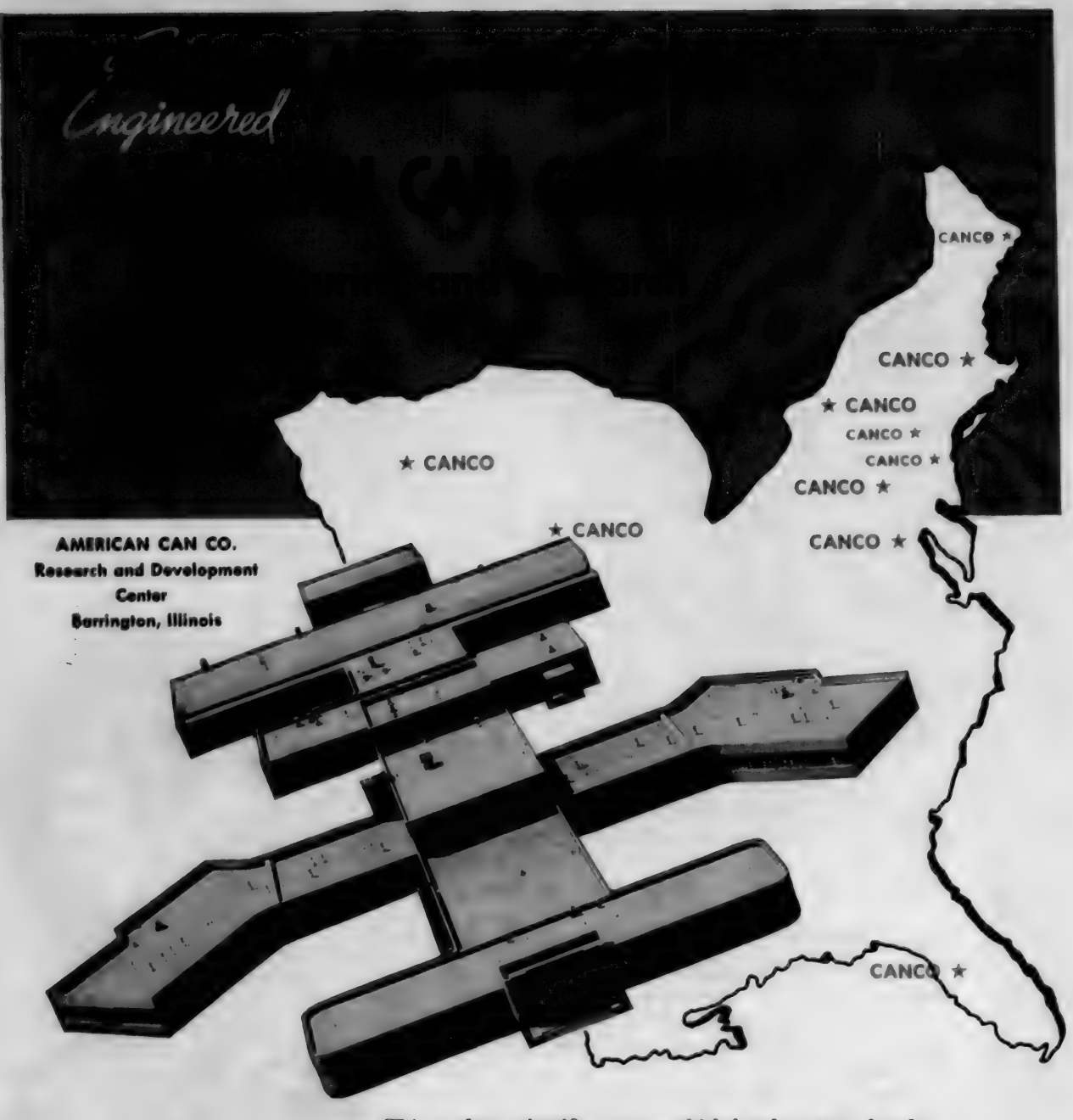
These and other features contribute to the famous "Buffalo" "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life — the best value you can recommend in a fan. For full details, write for Bulletin F-102.

"Buffalo"

BUFFALO FORGE COMPANY

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Engineered



AMERICAN CAN CO.
Research and Development Center
Barrington, Illinois

This modern scientific center—which has been two decades in planning—has been especially designed, engineered and equipped to develop and perfect the containers of tomorrow.

Kennard Corporation is most pleased to have been able to supply Kennard Air Conditioning products again for another American Can Company plant. Twelve Air Conditioning Units and ten Heating and Ventilating Units went into this latest and finest Canco Research and Development Center at Barrington, Illinois.

KENNARD CORPORATION
1823 HANLEY RD. • ST. LOUIS 17, MO.

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Specify "TUBE-TURN" and you know you're right

THIS TUBE-TURN* Welding Return has a bursting strength at least equal to that calculated for the seamless pipe with which it is recommended for use. Made in U.S.A., it meets all American Standard and Safety Code requirements. Welders everywhere know it will line up perfectly . . . because it's forged by the only process that produces a wall with the maximum uniformity of thickness and circularity. In short, when you specify "TUBE-TURN" you *know* you're right.

Your nearby Tube Turns' Distributor is at your service. He can simplify your planning, meet your requirements exactly, with industry's most complete line of welding fittings and flanges.

TUBE-TURN Welding Fittings and Flanges are made in U.S.A. They meet *all* U.S. piping code specifications.

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

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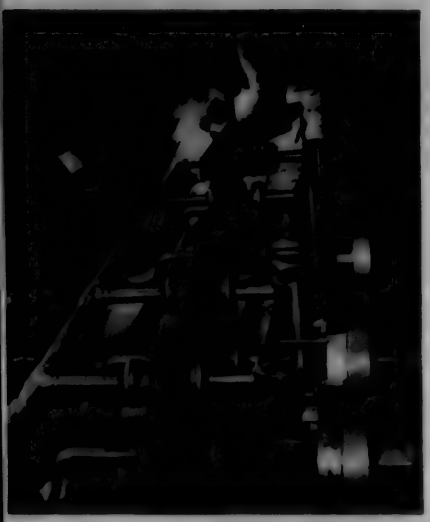

How TUBE TURNS' SERVICE can help simplify your piping jobs

1 ENGINEERING SERVICE

This unique press squeezes old automobiles into bales of metal to expedite scrap recovery. Designers of the press called on Tube Turns' Engineering Service for assistance in laying out the piping for the hydraulic system. Result—efficient, leakproof piping that enables the press to do its job on a two-minute cycle. Tube Turns' unmatched piping experience can help *you* when you have an out-of-the ordinary piping problem.

2 COMPLETE SELECTION

Here is a stainless steel nitric acid header using TUBE-TURN® Welding Fittings and Flanges for directional changes and valve connections. Stainless steel piping can provide long, safe service where corrosive gases or fluids are handled, or where temperature extremes are encountered. You can select TUBE-TURN Welding Fittings and Flanges in carbon steel, stainless steel, non ferrous metals and alloys, and in the schedules and sizes you need. Tube Turns offers industry's broadest line of welding fittings and flanges, covering over 4000 items.

3 FAST SERVICE

You expect a manufacturer to exercise strict quality control over his production—what about distribution of his products? Here again Tube Turns offers you outstanding service. Tube Turns selects *leading* distributors who maintain local stocks, are geared for fast service, and rate "A" for dependability. You can save purchasing time and inventory trouble when you work closely with your Tube Turns' Distributor. You'll find one in every principal city.

TUBE TURNS, Dept. B-5
224 East Broadway, Louisville 1, Kentucky
Please send bulletin on "Pipe and Fittings Material".

Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____

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®"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

Now every room and office can be comfortable

Iron Fireman SelecTemp heating has a thermostat in every room

The *ultimate* in heating comfort—*a thermostat* in every room—is both simple and practical with the Iron Fireman SelecTemp heating system. Occupants of each room or office can select any temperature desired, at any time. Rooms stay at the selected temperatures. Each room unit automatically compensates for heat gains and losses caused by changes in outdoor temperature, cold winds and warmth from the sun—increasing or decreasing heat output.

SELECTEMP HIGHLIGHTS

THERMOSTAT IN EVERY ROOM. Temperatures can be varied in every room to fit the "activity plan" and personal preference of the occupants.

MODULATED HEAT. Air circulation is continuous. Both temperature and volume of air are automatically modulated, as required to offset heat loss from room.

FILTERED, CIRCULATED AIR. Individual room air circulation prevents transmission of odors or bacteria from other rooms. Air is cleaned by a spun glass filter in each room unit. Filtered outside air can be introduced if desired.

BOILER LOCATION. Boiler can be placed in any desired location, with proper distribution of heat to every room. Year-around domestic hot water coils available.

LOW POWER COST. No electricity required to operate circulating fans. Nonelectric thermostats.

LOW INITIAL COST. Easily installed in either new or old construction. Small soft copper tubing (¼ inch I.D.) carries steam to individual room heater units. Return lines are ⅛ inch. Substantial savings in installation costs.

LOW FUEL COST. Temperature easily reduced in unused rooms. Also eliminates overheating.

AUTOMATICALLY BALANCED. No special adjustments of dampers, valves or orifices required to balance heating system. Each unit continuously regulates heat needed for each room. Automatically compensates for external heat sources such as fireplace or solar heat, without affecting temperatures of other rooms.

ECONOMICAL INSTALLATION AND OPERATION

Regardless of the type or size of structure; office building, hotel or apartment house, school, hospital, or house, SelecTemp heating can be economically and efficiently installed. Flexible copper tubing, smaller than your little finger, carries low pressure steam to each room unit.

In addition to individualized heating comfort SelecTemp brings substantial operating savings. The fuel waste resulting from overheating (symptom: occupants open the windows), and the unnecessary heating of unused space, is eliminated. A fan in each room unit, operated by a steam turbine, continuously circulates filtered warm air. No electricity is used for fans or thermostats.

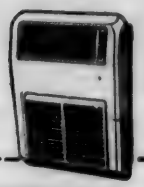
ASK FOR FULL INFORMATION

Before choosing a heating system for any building or residence, whether new construction or being modernized, it will pay you to get the facts about the Iron Fireman SelecTemp—a completely new concept in heating practice. Just mail the coupon or write.

Iron Fireman®

SelecTemp

MODULATING ZONE HEATING



Send for free booklet

IRON FIREMAN MANUFACTURING CO.
3069 West 106th Street, Cleveland 11, Ohio
In Canada, write to 80 Ward St., Toronto, Ontario.
Send literature on Iron Fireman SelecTemp heating.

Name_____

Address_____

City_____ State_____

Prudential "takes out insurance" on safety and dependability with USS NATIONAL PIPE

The Prudential Insurance Company of America adopted the policy of installing nothing but the best in their new Chicago office building. That's why almost 200 tons of National Steel Pipe were used in the construction of the ultra-modern skyscraper. Here's how the material was used:

- Approximately 120 tons of National Seamless, ranging in diameter from 6 inches to 20 inches, were employed as air conditioning carriers. These "risers" run from the sub-basement to the top floors.
- About 42 tons of National Seamless, ranging from 2 inches to 14 inches in diameter were used for heating and fan rooms.
- About 20 tons of National Pipe, from 1 inch to 3 inches in diameter, help make up the building's plumbing system.

It's no surprise that National Pipe is used in so many of the "big jobs" across the country. Engineers know from past experience that they can depend on National for safe, efficient, trouble-free service.

Write us for further information on the use of National Pipe in air conditioning, heating, and power installations. And, if you'd like some personal assistance with your pipe problems, get in touch with our engineers.

Prudential Building, Chicago, Illinois
ARCHITECT AND ENGINEER: Naess and Murphy, Chicago
GENERAL CONTRACTOR: George A. Fuller Co., Chicago

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL STEEL PIPE USS

UNITED STATES STEEL

NO LOSS of sales reported when Hess Brothers, Allentown, Pa., department store, installed this high pressure air conditioning system on its three upper floors. Linked with system already in use on lower floors, it points up the advantages of...

Kno-Draft High Pressure Air Diffusers

A neat solution to air conditioning a department store without disrupting sales was worked out by Carrier Corporation engineers for Hess Brothers, Allentown, Pa.

Key elements in the installation are Kno-Draft High Pressure Air Diffusers. These permit use of smaller than ordinary ducts, yet provide *draftless* air distribution and equalized temperature throughout the area. Built-in sound baffles assure quiet air delivery.

Installation was done in quarter sections on each floor simultaneously. Thus, only minimum rearrangement of selling space was necessary.

Dropped ceilings cover half the depth of ducts, giving them a shallow beam appearance. The Kno-Draft High Pressure Air Diffusers themselves are easily and quickly attached to the ducts.

Kno-Draft High Pressure Air Diffusion is one of the newest and most efficient methods of air conditioning. Connor engineers have prepared an authoritative 48-page textbook on the subject. Write on your letterhead for a copy of Bulletin K-33. Connor Engineering Corporation, Dept. J-105, Danbury, Connecticut.

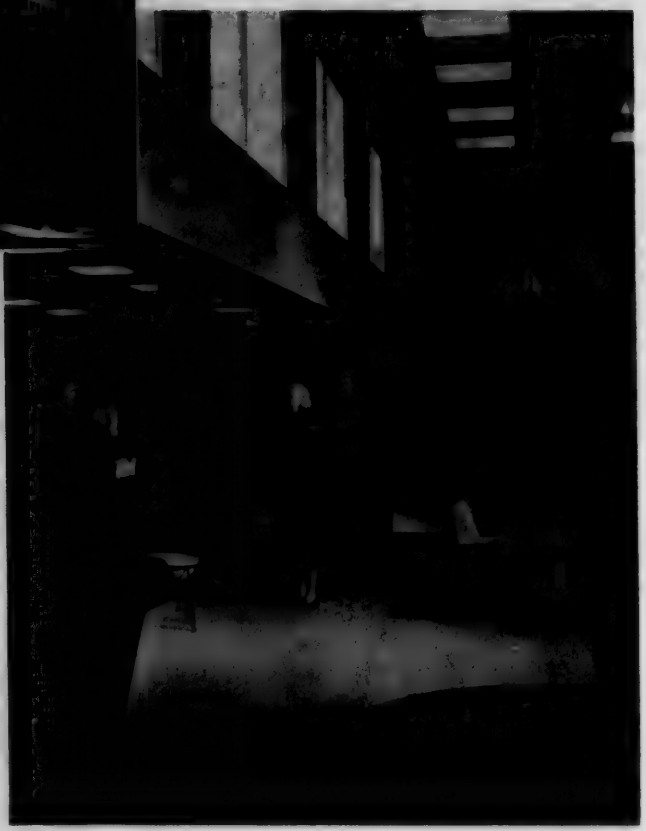
CONNOR

kno·draft®

high pressure air diffusers

BELOW: *Among the many features of the lobby are the clerestory illumination, the unobtrusive air diffusers, and the bas relief mural carved in wood by Buck Winn, Jr.*

Architects: Prinz and Brooks
General Contractor: Burgher Construction Co.



The New Look In

• Architecture
• Air Conditioning

The Oak Cliff Savings and Loan Association started eight years ago with $35,000—now has resources of $30,000,000. Its new building at Bishop and Center Streets is one of the finest in Dallas, and was awarded first honors for non-residential construction in 1954 by the Texas Society of Architects.

The entire structure, including the lobby, conference and accounting areas, community room and lounge, is air conditioned with two Frick "ECLIPSE" compressors. Each refrigerating machine is driven by a motor of 40 horsepower.

When you want the ultimate in quality and dependability . . . whether for air conditioning, refrigeration, ice making or quick freezing . . . specify FRICK.

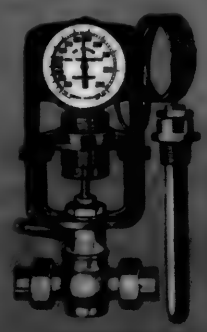
Get quotations now on the equipment you need: Branch Offices and Distributors in principal cities, the world over.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

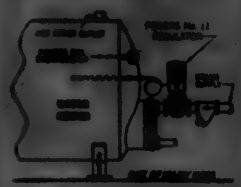
WAYNESBORO, PENNA. U.S.A.

WHY POWERS No. 11 REGULATORS Give BETTER CONTROL and Last Longer

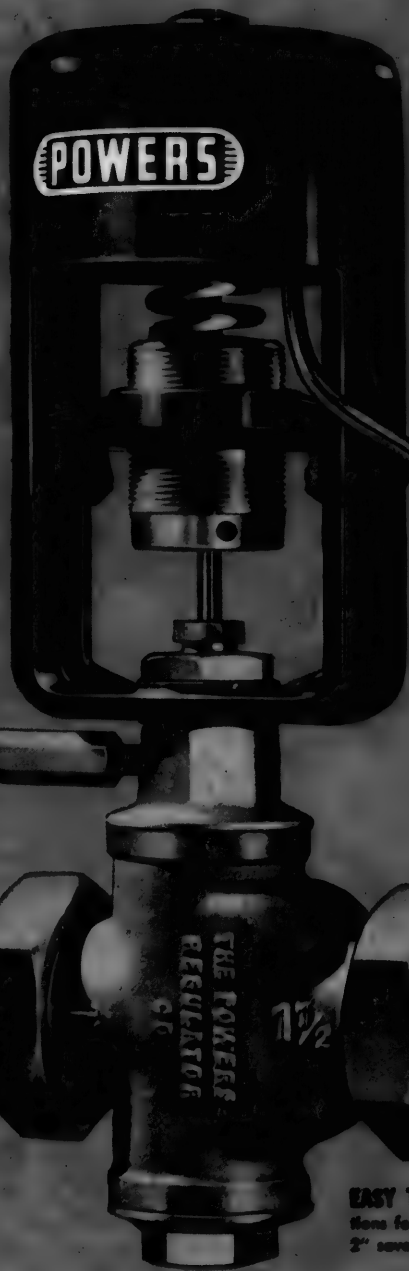


TEMPERATURE Indicating Regulator with Single Seat Valve

Simplest, Reliable **TEMPERATURE CONTROL** made for: Many Industrial Processes, Heat Exchangers, Air Compressors, Diesel Engines, Fuel and Crude Oil Heaters and Treaters.



SELF OPERATING Needs no Electricity.

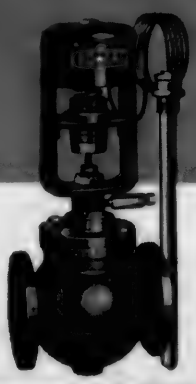


Better TEMPERATURE Control results from powerful bellows and minimum of valve stem friction. Valve Stem Lubricator aids easy movement of valve stem without binding. Double ply metal used in Powers bellows outlasts ordinary single ply type.

Controls Flow of Steam, Water or Gas

Balanced (Double Seat) Valve

EASY TO INSTALL bronze union connections for single and double seat valves thru 2" save installation time and labor.



Valve with Double Seat for sizes above 2

(c44)

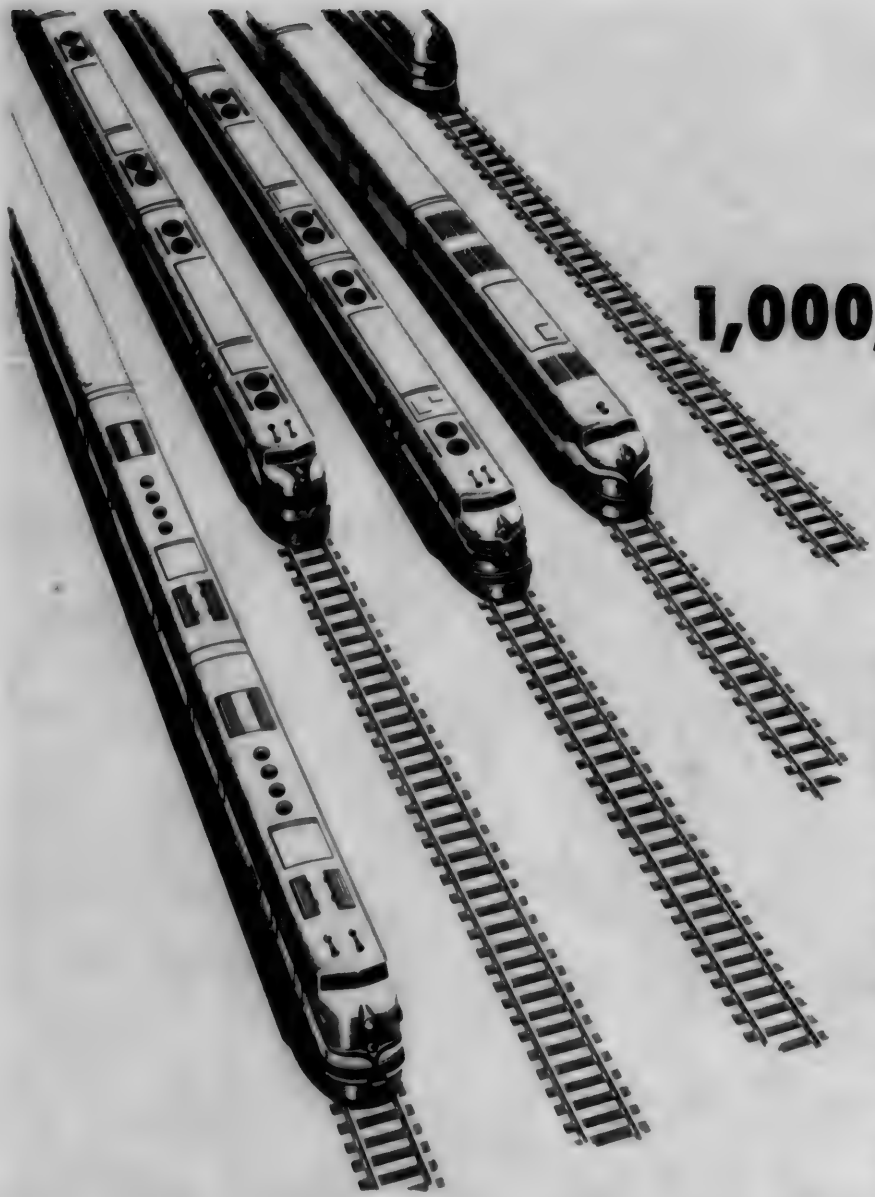
● **15 to 20 Years of reliable service** is often reported by users of Powers Temperature Regulators. Since 1891 they have been noted for their sturdy construction and dependability.

● Right type of Regulator and the right size valve is important for best control. From Powers complete line of self operating regulators and air operated temperature controllers you can be sure of getting the type best suited for your requirements. Call our nearest office or write us direct. 3400 Oakton St., Skokie, Illinois. Offices in Chief Cities.

POWERS CONTROL

Since 1891

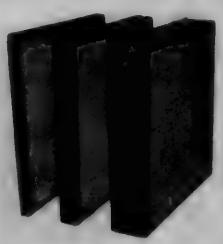
THE POWERS REGULATOR COMPANY



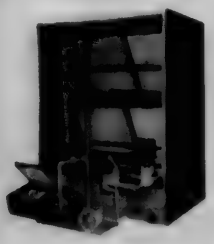
OVER 1,000,000,000 MILES OF TESTING

For many years, FAR-AIR® filters have been standard equipment on the country's leading railroads. They have earned this preference because of their proven ability to operate with uniformly high efficiency under every possible climatic condition. This toughest of all tests is watched critically by businessmen who not only demand top efficiency but economy as well. The fact that FAR-AIR filters have consistently come through with flying colors on both counts is your best assurance of satisfaction when this same equipment is used to solve your air filtration problems.

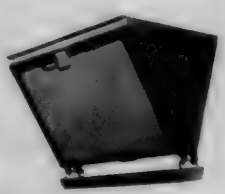
If you, too, look for reasonable first cost, low maintenance cost and high efficiency regardless of conditions, type of job or geographic location, you can depend on FAR-AIR. Write for complete catalog to FARR COMPANY, P. O. Box 45187, Airport Station, Los Angeles 45, California.



Heart of the FAR-AIR line is the 1", 2" and 4" thick filters. Available in all sizes and most metals.



Another FAR-AIR first. A completely automatic filter that washes and re-oils itself. Sizes to meet any CFM requirement.



A complete line of grease eliminators, easy to clean, safe to use, low in cost.

TYPICAL FAR-AIR PRODUCTS

ORIGINATORS OF FAR-AIR CERTIFIED FILTER SERVICE

FARR COMPANY

NO COMPROMISE ON QUALITY

Los Angeles, New York, Chicago

New Orleans

MANUFACTURED UNDER LICENSE BY FARR COMPANY MANUFACTURING LTD MONTREAL CANADA

There's built-in durability in

WEIRKOTE

for all sheet-metal work

Wherever a durable zinc-coated material is needed for sheet metal fabrication, there's nothing better than Weirkote. Gutters, downspouts, ducts—no matter what the application, the name Weirkote on galvanized steel means uniformly high quality steel, tightly coated with zinc to resist cracking, peeling, flaking and corrosion. The high quality is assured by Weirton's modern mills and methods—and men.

When your specifications call for galvanized steel, call Weirton, and be sure.

Weirkote is available in coils and cut lengths: gauges 16 to 30 inclusive. Maximum width—42", maximum cut length—168". Weirkote can be obtained to fit any customer requirement. For standard roofing and siding it is guaranteed to conform to A.S.T.M. specification A361-52T.

PITTSBURGH LOCK

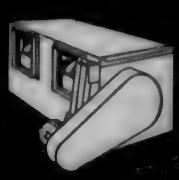
WEIRTON STEEL COMPANY

Weirton, West Virginia

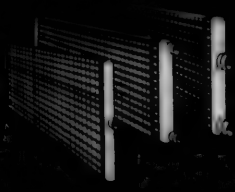
NATIONAL STEEL CORPORATION

HERMAN NELSON

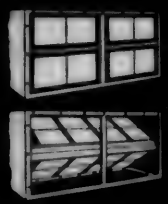
The Industrial Heater designed



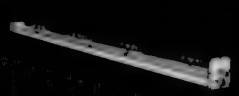
WIDE CHOICE OF FAN SECTIONS



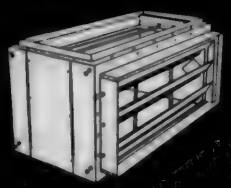
MANY RADIATOR TYPES AND CAPACITIES



CHOICE OF FILTER SECTIONS



HUMIDIFIER IF DESIRED



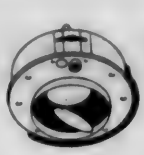
MIXING DAMPER SECTION IF DESIRED

AAF herman nelson

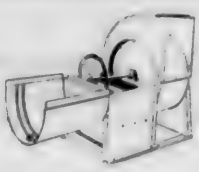
American Air Filter COMPANY, INC.

GENERAL OFFICES, LOUISVILLE (Ky.) • PLANTS IN LOUISVILLE, MOLINE (Ill.), MORRISON (Ill.), CHICAGO and MONTREAL (Canada)

A COMPLETE LINE OF INDUSTRIAL HEATING AND VENTILATING EQUIPMENT



HERMAN NELSON UNIT HEATERS



UNIT BLOWERS

with your needs in mind

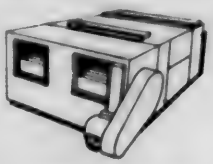
Use the versatile Herman Nelson Industrial Heater not only for comfort heating and ventilating in your plant . . . use it also for process drying, curing, air cleaning and other special heating-drying-ventilating needs. Use it for heating vast areas or small quarters, for directing heat at doorways or work areas. Install it anywhere — on wall, ceiling or floor—with or without ducts. Its big capacity does the job of many smaller, propeller-type units. Choose from heat capacities ranging to one million BTU's.

Engineered to be flexible, too, you can order the Herman Nelson Industrial Heater in your own choice of many standard components. And whatever your assembly of components, you can be sure it is *job-proved* by Herman Nelson. To help you plan specific installations, Herman Nelson field engineers are always available for consultation and recommendations. Mail coupon for complete information.

Every installation is custom-assembled from a wide range of standard components. You buy exactly what you need—no more, no less.

Pioneers in Air Care

CENTRIFUGAL FANS



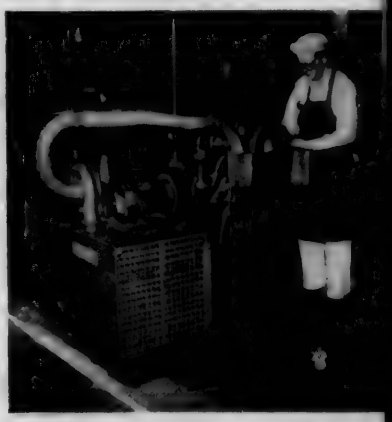
VENTILATING UNIT

Industrial AIR Is Our Business

AAF Herman Nelson

your one source for products that clean, heat and move AIR

AAF **ELECTRO-CELL with Type H Washer** —high efficiency air cleaning with pushbutton maintenance—the washer as an integral part of the unit simplifies installation.



AAF **ROTO-CLONE Self-Contained Units** offer a simple solution for such isolated dust problems as this grinder stand. Exhaust air is filtered and returned to workroom.

PORTABLE HEATERS being used to spot extra heat around workmen in a welding shop. Models available from 75,000 to 450,000 BTU. Oil or gasoline fired. Electric or gasoline powered.

ILLINOIS ENGINEERING STEAM SPECIALTIES and power controls have been standards of the industry for more than 50 years. Illustrated above is float and thermostatic trap.

AMERICAN AIR FILTER COMPANY, INC.
294 Central Avenue, Louisville 8, Kentucky

Please send me complete information on the following American Air Filter/Herman Nelson equipment:

- ☐ INDUSTRIAL HEATER
- ☐ UNIT BLOWERS
- ☐ UNIT HEATERS
- ☐ ELECTRO-CELL AIR FILTER
- ☐ MULTI-DUTY DUST COLLECTOR
- ☐ PORTABLE HEATER
- ☐ STEAM SPECIALTIES
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Trane CenTraVac now in new larger sizes!

Never before these features

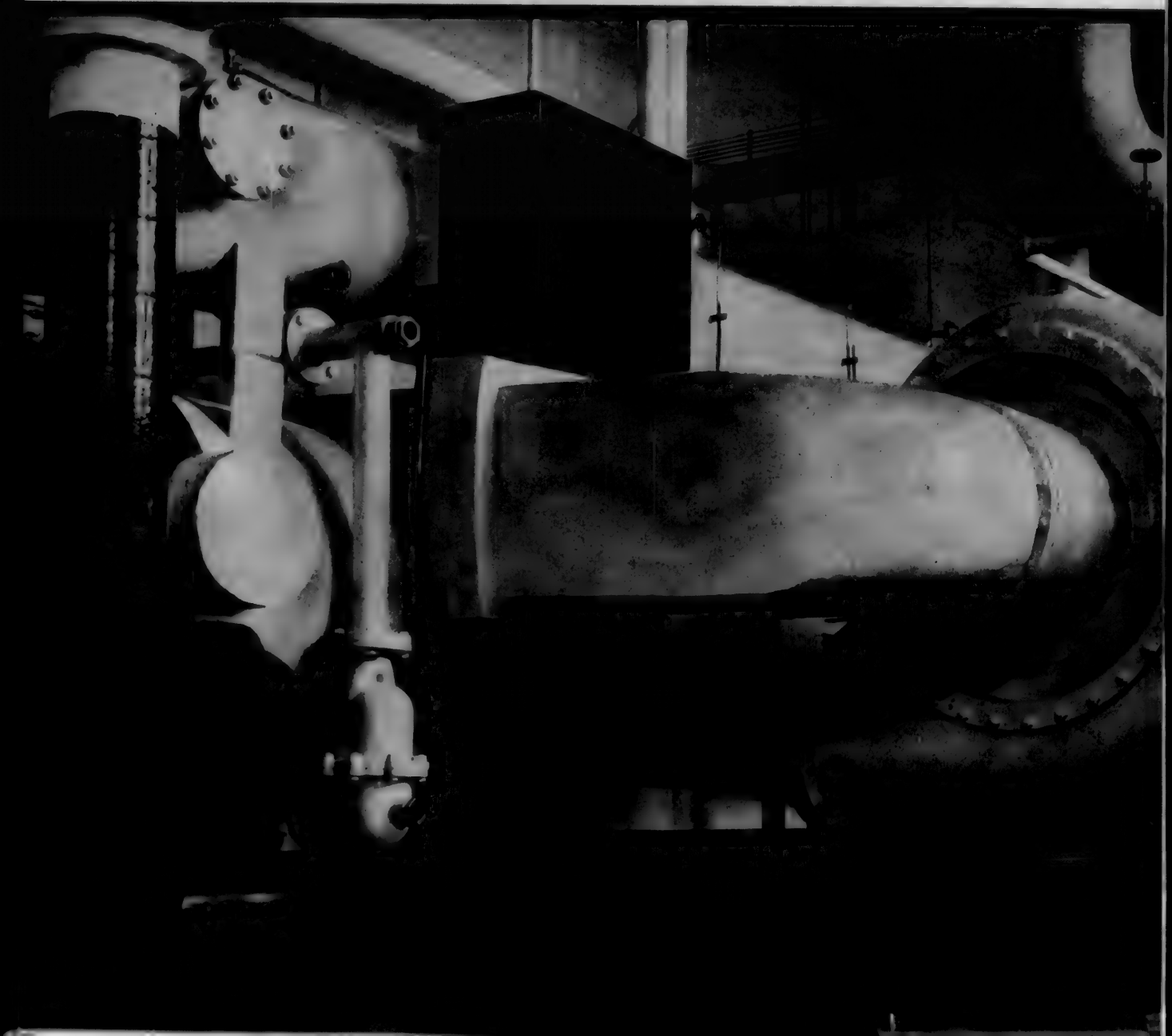
(1) HERMETIC CONSTRUCTION (2) FULLY AUTOMATIC OPERATION (3) STABLE OPERATION DOWN TO 10% OF CAPACITY

All the features of the famous Trane centrifugal that outsells all others combined!*

45 to over 800 tons water chilling capacity—in 11 basic compressor sizes!

Three completely new compressor sizes for your "big" jobs! And easier selection on *every* job because all the commonly used combinations of compressor, evaporator and condenser are covered by complete performance tables in TRANE CenTraVac literature.

In these new, larger sizes you get the same advanced features, the same efficiency and dependability that have made



**Based on Dept. of Comm. figures for units in same size range.*

in water chillers to 800 tons!

TRANE CenTraVac the fastest selling centrifugal in the entire industry in its size range. For example:

True hermetic design. No shaft seals to cause Freon loss. No gear box, heavy thrust bearings and couplings to require constant attention and maintenance.

Automatic, unattended operation. No need for full time supervision. Push a button to operate . . . from there on the CenTraVac starts, stops and modulates automatically!

Modulation to 10% of capacity. CenTraVac adjusts its use of power in almost direct ratio with the cooling load—from 100% down to 10% of capacity. You can provide for partial-load operation without the usual penalty in operating costs.

Easy installation, less maintenance. CenTraVac has only *one* major moving part, only *two* main bearings . . . and operates only when full oil pressure is applied to *both* bearings. Compressor is *factory aligned*, completely eliminating this problem in the field. Operation is always smooth, vibration-free.

No multi-level base required. CenTraVac may be set directly on any level concrete floor of sufficient strength to support its weight. No foundation bolts required.

For complete information on this *complete line* of TRANE CenTraVac hermetic centrifugal compressors, call your nearby TRANE Sales Office, or write TRANE, LaCrosse, Wisconsin.

TRANE Climate Changers—full line of factory-assembled air conditioners. 600 to 29,000 cfm.

TRANE UniTrane units—for multi-room air conditioning. Free-standing, recessed or ceiling models.

TRANE

MANUFACTURING ENGINEERS

One source, one responsibility for:
Air Conditioning • Heating • Ventilating
Heat Transfer Equipment

The Trane Company, La Crosse, Wis. • Eastern Mfg. Div., Scranton, Pa.
Trane Company of Canada, Ltd., Toronto • 90 U.S. and 17 Canadian Offices

New Trend in Specifications!

...FITZGIBBONS *Packaged* BOILER UNIT

SINGLE RESPONSIBILITY
A factory integrated and completely wired unit with all equipment *coordinated* into a heating package that meets *design performance.* Fire tested before shipment with performance backed by Fitzgibbons.

REALISTIC RATINGS
Rated on the basis of 8.2 sq. ft. heating surface per boiler horsepower with guaranteed gross output based on 5.0 sq. ft. of heating surface per boiler hp.

CERTIFIED EFFICIENCY
Factory tests assure high operating efficiencies.

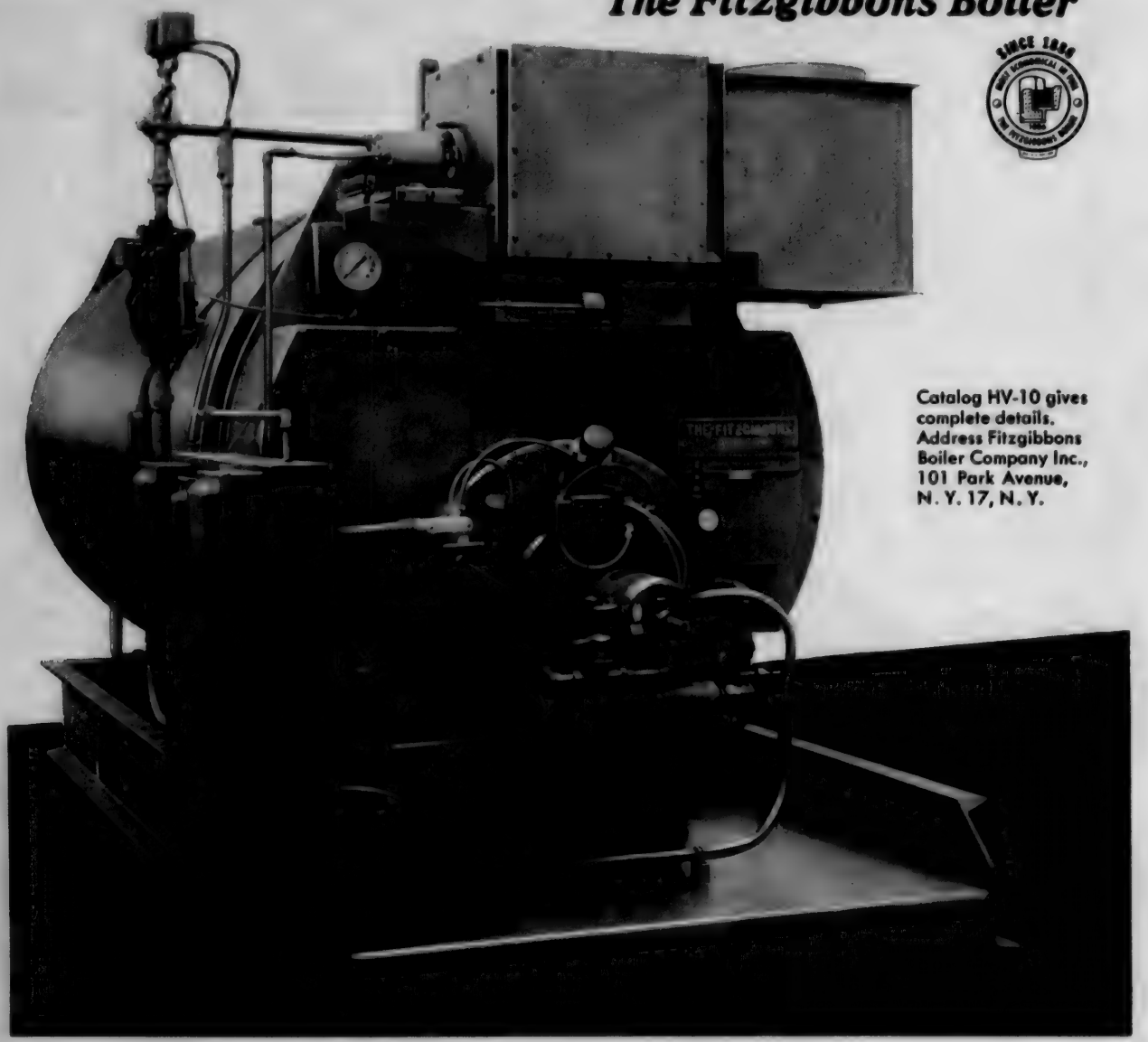
LOW COST MAINTENANCE
Full wet back construction of rear furnace walls (top, back and sides) eliminates rear refractory and recurring costs for maintenance and replacement.

FULLY AUTOMATIC
Latest and best control equipment for safe, sure operation with oil, gas or both.

CLEANER OPERATION
High quality induced draft fan assembly provides correct draft at all times and results in cleaner, quieter operation.

Engineered by the makers of . . .

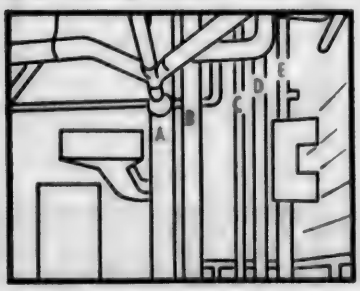
The Fitzgibbons Boiler®



Catalog HV-10 gives complete details. Address Fitzgibbons Boiler Company Inc., 101 Park Avenue, N. Y. 17, N. Y.

Main pipe shaft. Note compact assembly made possible by the trim, space-saving copper tube and fittings. See pipe sizing diagram below, left.

Mexico's newest and tallest skyscraper. General Director: Adolfo Zeevaert, C. E. Constructed by the Engineering Department of "La Latino Americana, Seguros de Vida, S. A." Plumbing contractor, Técnica, S. A.



A. 8" soil stack. B. 6" vent. C. 3" hot water. D. 4" cold water. E. 3" waste for future use. Laterals to soil stack are 4". All sanitary drainage lines are Type M.

43-Story all-copper plumbing... in Mexico's tallest building

COPPER | **hot and cold water lines**
sanitary drainage system
roof drainage lines

100,000 pounds of copper tube, Types K, L and M, provide lasting protection against rust in the plumbing system of this beautiful, ultra-modern office building of the Latino Americana Insurance Company, Mexico City. Tube sizes ranged from ⅛" to 12" incl. Anaconda tube was used throughout, with Nacional de Cobre of Mexico furnishing the smaller sizes.

For a skyscraper or a small home, copper tube plumbing saves installation time and effort... often the over-all cost is less. Its light weight makes it easy to handle. Standard 20' lengths eliminate many joints. Assembly work with solder-type fittings is quickly and easily accomplished.

For economical, non-rusting plumbing specify ANACONDA Copper Tubes and ANACONDA Solder-Type Fittings. A wide range of sizes are stocked by Anaconda distributors throughout the country. Descriptive literature is available. Write to *The American Brass Company, Waterbury 20, Conn.* In Canada: *Anaconda American Brass Ltd., New Toronto, Ontario.* 5511

for copper tubes see your

ANACONDA®

distributor

Delivery...ON TIME...

A delay on this particular job meant valuable time lost . . . dollars wasted . . . Ric-Wil, not only prides itself in offering the finest in prefabricated insulated piping, but takes pride in ON TIME DELIVERY . . . and speaking of delivery . . . the best way to meet piping construction schedules is to contact your Ric-Wil representative early in the planning stage. He will be glad to help on scheduling delivery . . . and "lend a hand" on technical information as well.

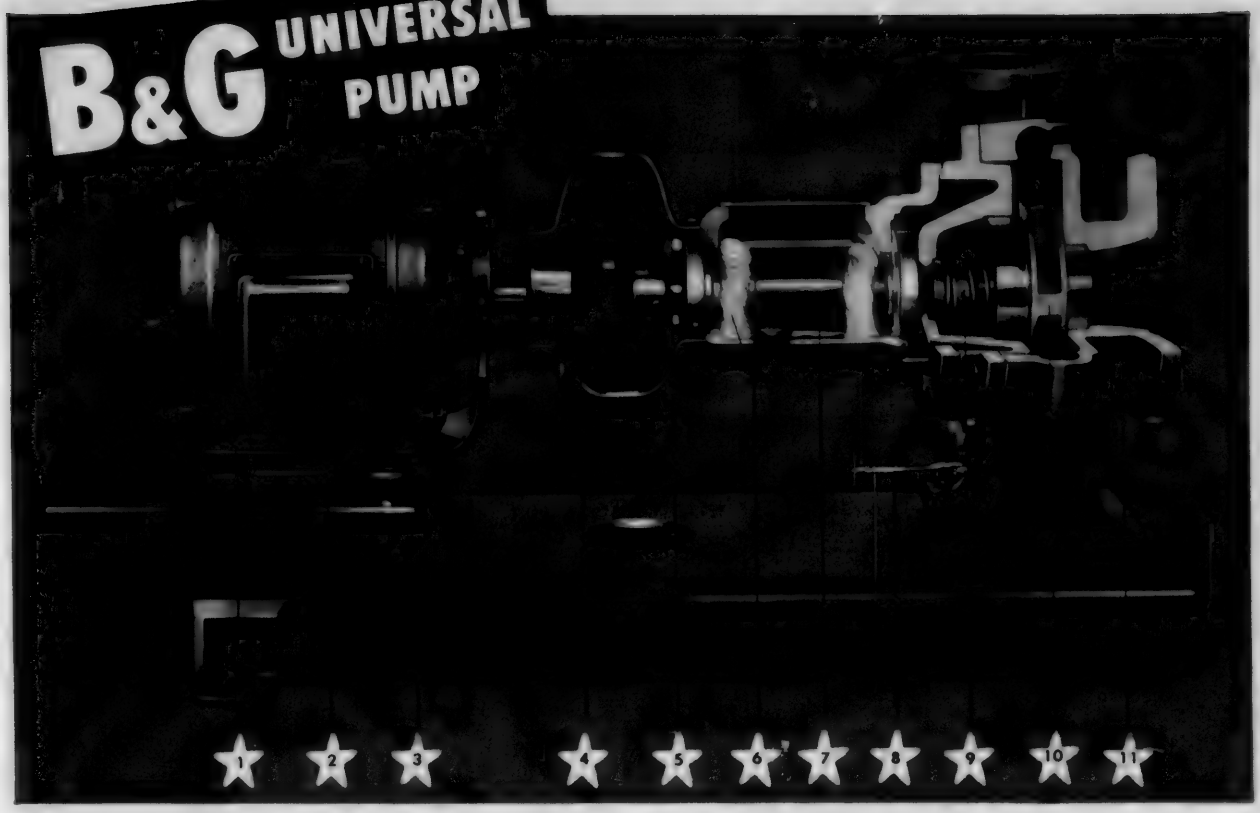
New Ric-Wil catalog is available . . . write for your copy . . . now.

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

RIC-WIL INCORPORATED

PREFABRICATED INSULATED PIPING SYSTEMS

BARBERTON, OHIO



DESIGNED SPECIFICALLY FOR *QUIET* OPERATION

IN LIQUID HEATING AND COOLING SYSTEMS

No vibration eliminators or flexible connections needed

The circulating pump in a hot water heating or chilled water cooling system is the connecting link between the mechanical equipment in the boiler room and the structure itself. *Silent, vibration-less* operation is therefore the prime requirement in a pump for this type of service. The features starred above are the reasons why the B&G Universal Pump fully meets this need.

THE MOTOR

1. **Extra quiet.** The Universal Pump motor is specially constructed, tested and hand-picked for extra-quiet operation.
2. **Sleeve bearings.** Motors are equipped with oil lubricated bronze sleeve bearings—essential to silent operation and long life.
3. **Mounting.** Universal motors, through 5 HP, are NEMA ring-type mounted and completely suspended in noise-dampening rubber. All motors are drip-proof.

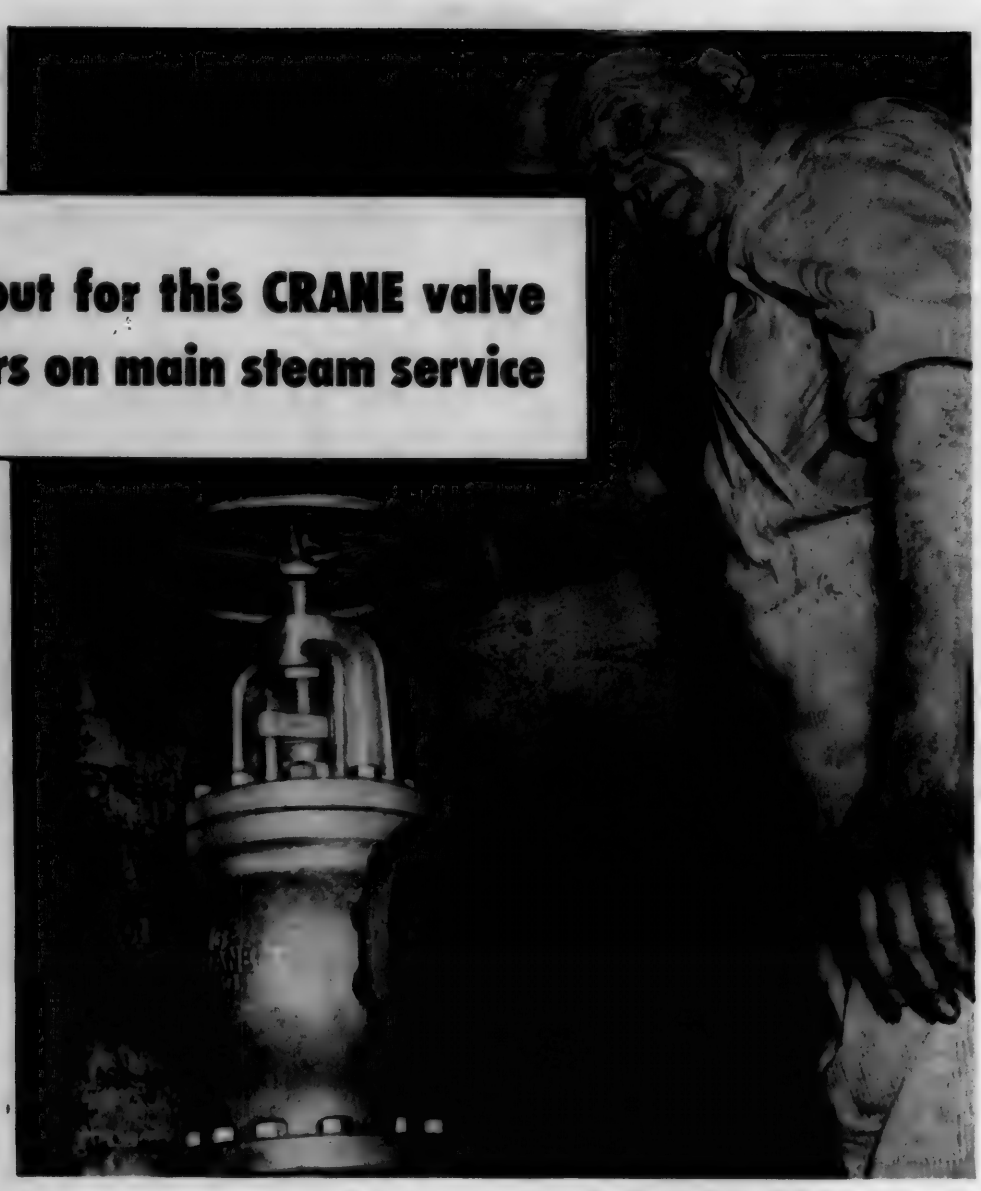
THE PUMP

4. **Coupler.** Self-aligning, spring-type . . . another warranty of silent operation plus excellent pump and motor protection against the stresses of starting torque.
5. **Shaft.** Big—oversized—affording large bearing surfaces. Made of special alloy steel, polished to mirror finish. Heat-treated integral thrust collar absorbs end-thrust . . . lengthens seal and motor bearing life.
6. **Lubrication.** Genuine oil circulating. No grease to channel or harden. Oil level indicator permits visual check.
7. **Sleeve bearings.** An essential for quiet, vibrationless operation and long life of both pump and motor. An outstanding Universal feature.
8. **Removable bearing frame for easy servicing.** The entire bearing frame assembly with impeller is easily removed from volute. No pipe connections to break or motor to remove . . . all the advantages of split case design. All bearing frame assemblies are interchangeable.
9. **Mechanical seal.** Positively prevents water leakage up to full design pressures. The seal is self-lubricating and features a floating seat of diamond-hard "Remite"—a B&G development.
10. **Hydraulically balanced impeller.** Balancing chamber and thrust pressure relief holes in the impeller reduce thrust to a minimum.
11. **Solid volute.** Support feet directly below volute absorb piping strains without distorting pump alignment.

Write for capacity data

BELL & GOSSETT
COMPANY
Dept. EB-4, Morton Grove, Ill.
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, West Toronto

No time out for this CRANE valve in 40 years on main steam service



THE CASE HISTORY—Two Crane 250-pound iron body angle valves—6-inch (shown) and 5-inch size—scored this exceptional service record.

They were installed in 1915 on the main steam leads from boilers in the plant at Delavan, Wis., now occupied by The George W. Borg Corporation. In 40 years' uninterrupted service these Crane valves never failed to operate properly nor caused a shutdown. With but routine maintenance, they opened fully and were seated tight with ease under infrequent operation. Working pressure of boilers was originally 150 psi.—later reduced to 75 psi. This year, both valves were retired. The new replacements are Crane quality valves, of course.

Crane iron valves in particular need no introduction to thrifty buyers. In all grades, Crane iron castings generously exceed the requirements of equivalent A.S.T.M. specifications. Crane Ferrosteel, for instance, used in 250-pound valves is 35% stronger than ordinary cast iron.

In any pressure class, you'll find Crane quality outstanding. Choose from complete lines of gates, globes, angles and checks. Your Crane Representative can give valuable help in specifying and ordering.

Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers serving all industrial areas.

CRANE CO.

THRIFTY BUYER

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

A new high in **HIGH VELOCITY**

The photograph above shows main banking floor of the First National Bank in Dallas. Note how straight line All-Air High Velocity units blend perfectly into the architectural design. *See next page for detail.*

The All-Air High Velocity system also provides draftless comfort throughout the bank as well as in the second floor executive offices (shown at left). *See next page for detail.*

Architect: George L. Dahl

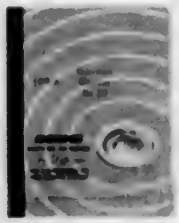
Consulting Engineer:
Landauer, Guerrero & Shafer

Contractor:
C. Wallace Plumbing Co.

Main banking floor

These pages illustrate the use of the Anemostat All-Air High Velocity distribution system in a modern air-conditioned bank. Anemostat High Velocity units are also being used throughout the country in many other applications such as hospitals, schools, department stores, office buildings and plants. • Here are some of the important architectural and engineering advantages of the Anemostat All-Air High Velocity distribution system. It can be used with smaller than conventional ducts. It can be installed faster and at less cost. It requires no coils, thus eliminates leakage, clogging and odors. Anemostat round, square and straight line diffusers with high velocity units are adaptable to a wide variety of architectural designs.

For latest data on Anemostat All-Air High Velocity units, write on your business letterhead for new Selection Manual 50.



Second floor executive offices

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA

10 East 39th Street, New York 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

One of a series appearing in **FORTUNE, TIME, NEWSWEEK, BUSINESS WEEK** *and leading architectural magazines.*

"Personally, I always specify Lewin-Mathes Copper Tube"

We welcome stiff-necked specifications.

We meet them . . . because the copper we form into tube is first *refined by us* in our own plant.

We meet them . . . because Lewin-Mathes' *completely integrated operation* permits a standard of quality control—from raw material to packaged tube—that is unsurpassed anywhere in the industry.

As refiners, we know the copper going into Lewin-Mathes Tube is pure. As fabricators, we painstakingly control every physical and chemical property of the finished product. And as *integrated specialists*, we take pride in delivering every foot of Lewin-Mathes Copper Tube uniform and perfect . . . to meet your most exacting requirements.

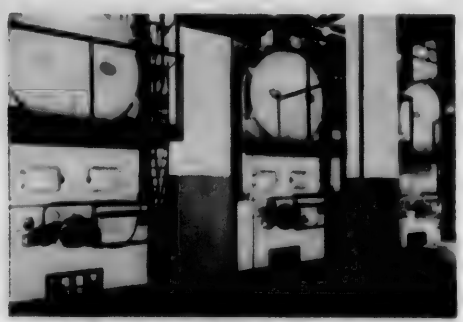
Nothing primitive about Lewin-Mathes supply facilities. Our products are available through Wholesale Distributors, serviced by Lewin-Mathes Mill Depots throughout 48 states.

LEWIN MATHES
SAINT LOUIS, MISSOURI
MANUFACTURERS OF
COPPER AND BRASS TUBE, PIPE, ROD AND FITTINGS

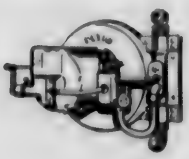
TISHMAN REALTY AND
CONSTRUCTION COMPANY, INC. INSTALLED

20 PETRO OIL BURNERS

IN TEN BIG NEW YORK BUILDINGS



Sutton Terrace (shown at top) consists of three 12-story buildings accommodating 495 families. Heat is supplied by three Titusville boilers, each rated at 42,500 sq. ft. of radiation and each fired with a WD 8 AH Petro burner. This installation has three 15,000 gallon, 10 ft. diameter fuel storage tanks.

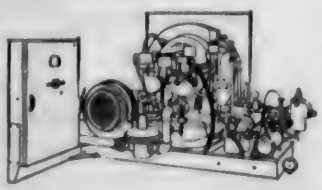


ROTARY OIL BURNERS

Horizontal rotary oil burners make possible substantial fuel savings by burning the low-cost heavy fuel oils with complete dependability. Models for every industrial need. Capacities up to 600 boiler horsepower.

COMPLETE PACKAGED UNIT

A complete forced draft combustion system with all parts factory assembled and tested. Saves installation time and cost, gives top performance and fuel economy.



***"Petro oil burners give us the cleanliness, dependability, and economy of operation we require,"* says Alan Tishman**

Providing heat for 9 huge apartment developments and power for a 13-story manufacturing plant is a tremendous responsibility, but Tishman Realty and Construction Co. Inc., have found that they can rely on Petro oil burners to do the job. "The ability of our Petro oil burners to immediately respond to fluctuating heat and power demands without over-firing or under-firing is a vital factor in keeping our fuel costs low and our tenants happy," says Mr. Alan Tishman.

Oil automatically preheated for sure firing and lower fuel cost To insure quick positive starting and steady, uniform firing, Petro oil burners automatically *preheat* oil to an efficient temperature before it is injected into the firebox. This Petro method of preheating oil also enables users to burn the heavy fuel oils (Nos. 5 & 6), which average 8% richer in heat value, without complicated mechanical gadgets that cause service and adjustment problems. You save worry *and* money with Petro oil firing.

PETRO oil burners are adaptable to any boiler room

Petro industrial oil burners are designed and built to *modernize* the firing of your present boilers. The flame is adjustable to any firebox, and the installation is adaptable to any boiler room layout. This means that you save substantially on initial installation costs, and save more money every day on fuel and labor costs. Mail coupon for free catalog and information.

CLIP AND MAIL FOR FREE CATALOG

PETRO
3247 West 106th St., Cleveland 11, Ohio.
In Canada: 2231 Bloor St., West, Toronto, Ontario.

Name_____

Company_____

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PETRO

T. M. REG. U. S. PAT. OFF.

OVER 50 YEARS OF LEADERSHIP IN AUTOMATIC HEATING AND POWER EQUIPMENT

Air Conditioning's #1 Problem...

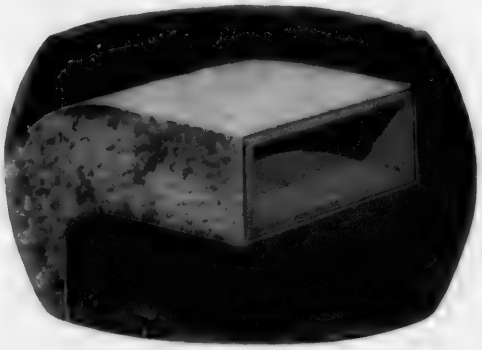
how to move air without "FAN-FARE"

Recent studies show that noise control is one of the prime problems of air conditioning today. Time and again, homeowners and businessmen complain that "fan chatter" and other objectionable noises seriously interfere with their rest and work.

The best possible way to keep your comfort-cooling customers from getting hot under the collar about noise is to install a few feet of ULTRALITE* Duct Liner in the plenum and short supply and return ducts. It's easy . . . it's inexpensive . . . it's effective — yet this simple precaution can make all the difference between a satisfactory and an unacceptable air conditioning job.

That's why it is good practice today for architects and engineers to specify ULTRALITE glass fiber duct liner on every job. That's why contractors who want nothing but satisfied customers line ducts even on jobs where duct liner is not specified.

*Reg. U. S. Pat. Off.



ULTRALITE is a flexible, semi-rigid glass fiber insulation designed specifically as an acoustical duct liner, with excellent sound-absorbing properties. Because of its unique long textile-type glass fiber composition, ULTRALITE is the strongest, most resilient glass fiber insulation. That's why it will not break, chip, delaminate or flake off in the air stream. ULTRALITE is available coated one side to minimize air friction loss. Local stocks in 57 cities are maintained to give you delivery when and where you need it. Your nearby distributor is listed in the Yellow Pages under "Gustin-Bacon Insulations."

GUSTIN-BACON *Manufacturing Company*

Thermal and acoustical glass fiber insulations • Pipe coverings and fittings • Railroad gaskets and supplies

222 W. 10th St., Kansas City, Missouri

NEWS!

NOW YOU CAN CROSS UNSIGHTLY PENTHOUSE TYPE ROOF VENTILATORS OFF YOUR LIST!

WITH THESE

MODERN CARNES MODELS

MODEL CL

This streamlined, low silhouette model is precision-built for smooth, quiet, efficient operation. Plus these outstanding features . . . wide capacity ranges; all-aluminum construction; heavy duty, ball-bearing, protected motors; all models with backwardly inclined, non-overloading centrifugal fan wheels.

MODEL J

Also designed for today's low parapet buildings, with all-aluminum spun housings to eliminate corrosion and maintenance problems. Features include . . . centrifugal fan wheels statically and dynamically balanced; heavy duty precision pillow block and drive; specially designed vibration isolators. In fan wheel sizes from 24" to 48".

At Carnes, a specially designed building houses complete facilities for expert engineering and thorough testing under actual operating conditions . . . your assurance of the finest quality in every product that bears the Carnes name.

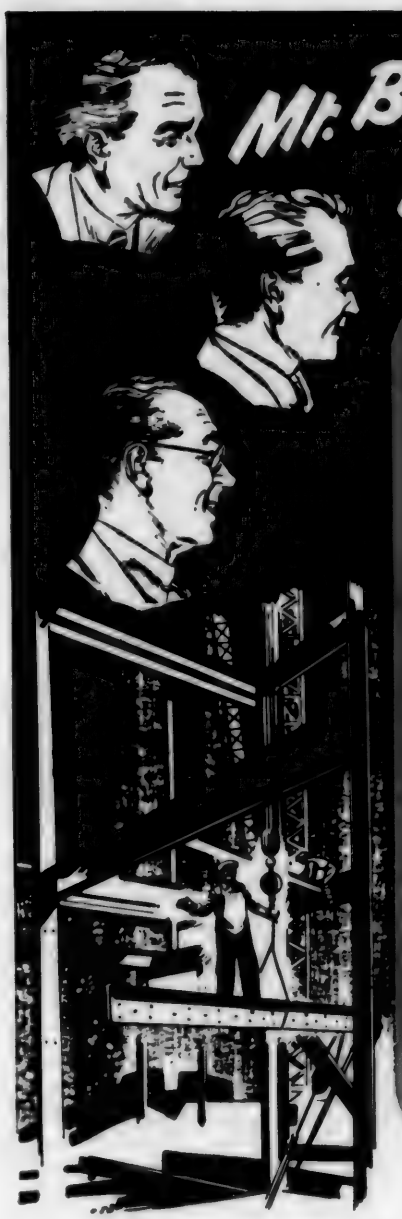
WRITE FOR

FREE BOOK

A complete story on Carnes facilities, products and performance data. It's yours for the asking.

CARNES CORP.

VERONA, WISCONSIN



Mr. BUILDER— Mr. ARCHITECT— Mr. CONTRACTOR—

YOU can do a BETTER Job with READING Copper Tube

YOU can recommend and install Reading Copper Tube with the complete assurance that any product bearing the Reading label is second to none. Through all the phases of production of Reading Copper Tube, constant metallurgical, hydrostatic, physical and visual tests maintain the highest and most rigid standards of quality.

Specify Reading . . . *it's a name you can trust!*

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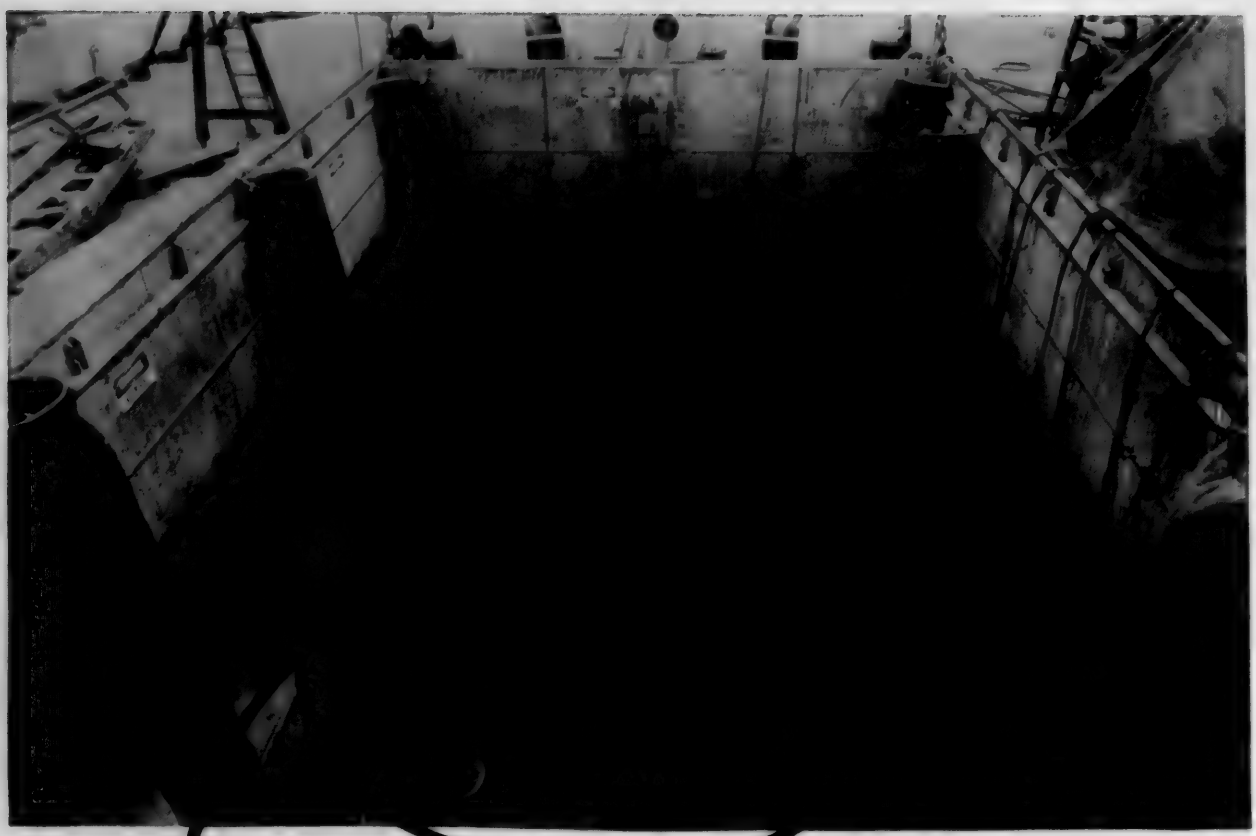


Ventilation for Spray Painting

. . . A JOB FOR JOY AXIVANE® FANS

Unexcelled performance in tight quarters, plus rugged compactness and fast, easy installation and relocation of the units when necessary . . . those were the main reasons why Joy Series 1000 Axivane Fans were selected for the vital job illustrated above. They're exhausting toxic, explosive fumes from spray-painting operations in enclosed areas below-decks in a large ship. Canvas ducts carry the fumes to open air on an upper deck.

Another shipboard job: a deck-mounted Series 1000 Fan provides air circulation in ballast tanks—5000 cfm at 5" pressure.

Applications like these effectively demonstrate the inherent advantages of Joy fans. Their vaneaxial design is highly efficient, yielding a maximum air volume-to-power ratio. Blades are of true airfoil shape, and are readily adjustable for maximum flexibility to meet varying conditions. Thick steel casings are used in the sturdy construction that smothers operating noise.

Series 1000 fans are available in 136 models, from 18" to 84" in diameter. Duties range from 600 to 200,000 cfm, and from .125" to 11" total pressure. They're easily installed right in the duct in horizontal, vertical or inclined positions with direct drive, and available also with V-belt drive. ● Let's talk over *your* fan problem—or write for Bulletin J-611. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

JOY

WORLD'S LARGEST MANUFACTURER OF VANEAXIAL-TYPE FANS

A Complete Line of Centrifugals for Air Conditioning from

MYERS

tops in pumps since 1870

FULL RANGE OF SIZES
⅓, ½, ¾, 1, 1½, 2, and 3 horsepower, motor-mounted or belt-driven models.

TWO CASING SIZES
1″ x 1¼″ or 1¼″ x 1½″.

ALL-BRONZE IMPELLER
Accurately balanced for smooth operation.

REMOVABLE BRONZE WEARING RINGS
Easily replaced for longer pump life.

ROTARY SEAL
Eliminates leakage (stuffing box may be specified on "125" models).

CORROSION-RESISTANT SHAFT
Stainless steel for trouble-free service.

WIDE RANGE OF CAPACITIES AND HEADS
Capacities to 90 GPM. Heads to 135 feet.

Write today *for Bulletin 210 on* Myers *Centri-Thrift Pumps.*

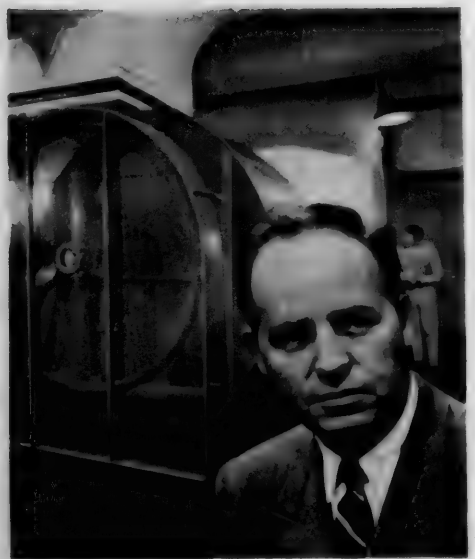
Myers

PUMPS WATER SYSTEMS AND WATER SOFTENERS

The F. E. Myers & Bro. Co., Dept. HV-10, Ashland, Ohio

New John Wanamaker Department Store, Wynnewood, Pa. Architects: Wallace & Warner; consulting engineers: Stewart A. Jellett Company; heating and ventilating contractors: Daniel J. Keating Company—all of Pennsylvania.

American Blower supplies the weather in Wanamaker's new suburban store



"Quiet operation is a big benefit of American Blower equipment," says Daniel J. Keating, Jr., air-conditioning contractor. "For over 37,000 cu. ft. of air is filtered, conditioned, recirculated every minute."

Except for entrance-and-exit doors, the new three-floor John Wanamaker Department Store in suburban Philadelphia has no exterior openings. Yet it is always comfortable inside, thanks to American Blower equipment—which furnishes conditioned air, summer and winter, to maintain an even and desirable temperature. Each store level has its own American Blower supply and return system.

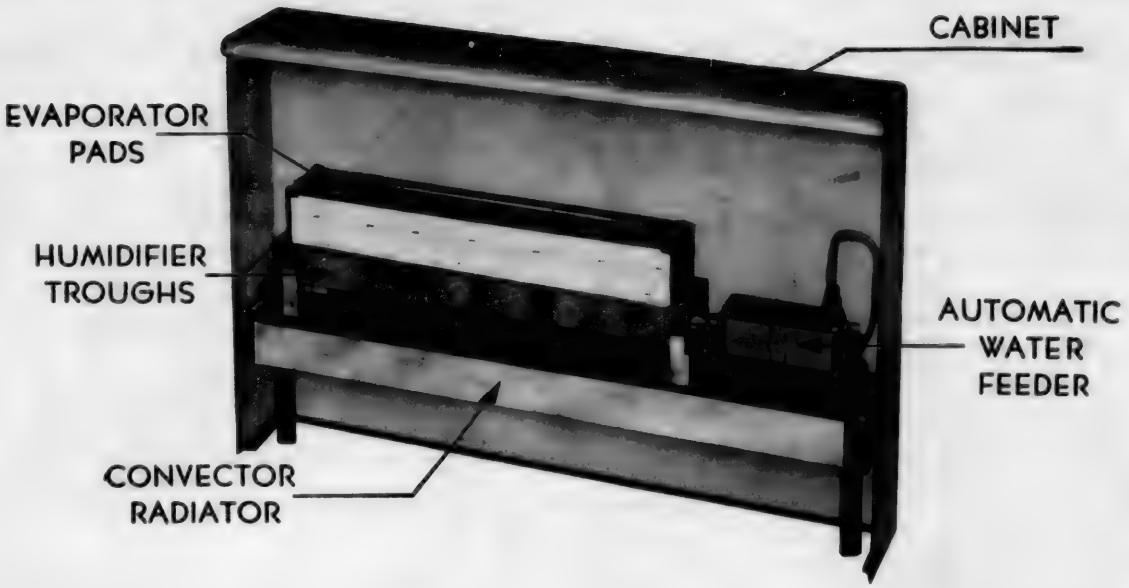
Says Wanamaker's chief engineer, Frank Mescal—"In selecting air-handling equipment, one of our main requirements was that it must be free of noise and vibration. American Blower equipment was the perfect choice. For not only has it proved quiet, but trouble-free in operation as well."

If air conditioning is in *your* plans, why not talk to an experienced representative—at our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

Now! AUTOMATIC HUMIDIFIERS FOR CONVECTOR RADIATORS



The only automatic humidifier on the market made especially for modern convector radiators

BIG FEATURES

- Only 3⅜ inches deep. Fits even the extremely shallow convector cabinets.
- Water is supplied directly to feeder from the convector on hot water systems. On steam installations, water is taken from nearest supply through copper tubing.
- Completely automatic. Float-controlled valve keeps water line constant.

BIG PERFORMANCE

- Maximum evaporating area. Unique design of water troughs makes every inch of this humidifier a working surface which creates more evaporating area.
- Minimum air restriction. The separate, narrow ⅜ inch troughs which hold the evaporator pads are spaced to allow free flow of heated air between the pads and on all sides of unit.

Available in both 2 and 4 trough units in 10 different sizes.

The new Maid-O'-Mist Convector Humidifiers are made in evaporating capacities of 1 to 5 gallons per day. Construction throughout is of non-ferrous metal. Easy to install. Get full information from your jobber or write us direct for complete details.

MAID-O'-MIST Inc.
HEATING SPECIALTIES

AUTOMATIC HUMIDIFIERS . . . . . AUTO-VENTS
WATER LINE CONTROLS . HEATING SPECIALTIES

MAID-O'-MIST, Inc.

3217 NORTH PULASKI ROAD . CHICAGO 41, ILL.

On duct-insulation jobs—

Low installation cost of Microlite and L·O·F Super·Fine can clinch the contract

Speed and ease of application can mean the difference in cost it takes to clinch a big insulation contract. That's why many contractors use L·O·F Glass Fibers' Super·Fine and Microlite to cut application costs without sacrificing insulating efficiency.

You'll find it simple to apply—These soft-textured blankets are pleasant to handle, quick to apply. Require no special tools or skills. Lightweight, resilient L·O·F Super·Fine and Microlite fill hard-to-reach places and are easy to manage on tall ladders or scaffolds. An unskilled worker can apply an average of 500 square feet of insulation a day.

The high insulating efficiency of Microlite and L·O·F Super·Fine results from the countless dead air cells formed by millions of fine glass fibers, which effectively reduce heat loss or gain.

Save on storage space, too—L·O·F Super·Fine and Microlite come in tightly compressed rolls that take up less space and spring back to full thickness when unrolled. Available in blanket form up to 72″ wide, 5″ thick and from 50′ to 200′ long, depending on thickness. Also available with various facings to meet different insulation and code requirements.

Save on duct application costs with Microlite or L·O·F Super·Fine duct wrap and duct liner. Look in the Yellow Pages of the telephone directory for the name of our nearest distributor, or write: L·O·F Glass Fibers Company, Dept. 63-105, 1810 Madison Avenue, Toledo 1, Ohio.

Time- and cost-saving steps in a typical duct application

1. Super·Fine and Microlite cut easily with an ordinary knife. No precision measuring or fitting required. In this case, adhesive is brushed on the insulation.

2. Lightweight, strong blankets of Microlite or Super·Fine handle easily on scaffolds or ladders.

MICROLITE

L·O·F GLASS FIBERS

SUPER·FINE

L·O·F GLASS FIBERS COMPANY

TOLEDO 1, OHIO

Makers of glass fibers by the exclusive "Electronic-Extrusion" process

3. Super·Fine and Microlite can be fitted quickly around the duct and supporting hangers. Light-gauge wire ties complete the job.

Insist on the New *Classic* Thermostat...

Get Accurate Heating Control
Attractive, Modern Styling
Easy, Inexpensive Installation

Install DETROIT CONTROLS'

New *Classic* Thermostat

for Customer Satisfaction!

The Classic will add style and saleability to the heating systems you manufacture, sell or install.

Its smart, modern design will complement the decoration of any home, new or old. The single, large numbered dial is slanted for perfect vision—can be read at a glance! The temperature selector is directly under the indicator needle—eliminates fumbling with old-fashioned turning or twisting devices.

Installation is very simple. No precision levelling is necessary. The Classic requires only two wires—easily replaces any two or three wire thermostat of earlier design.

Close control of any type heating, within a *fraction of a degree,* is assured by Detroit Controls' Timed Cycling function.

National advertising in Better Homes & Gardens, Small Homes Guide, Home Modernizing and other magazines will bring broad consumer acceptance to the Thermostyled Classic.

Take Advantage of this opportunity...

SELL THE *Classic*

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CORPORATION

6900 TRUMBULL AVE. • DETROIT 8, MICHIGAN
Division of AMERICAN RADIATOR & STANDARD SANITARY Corporation

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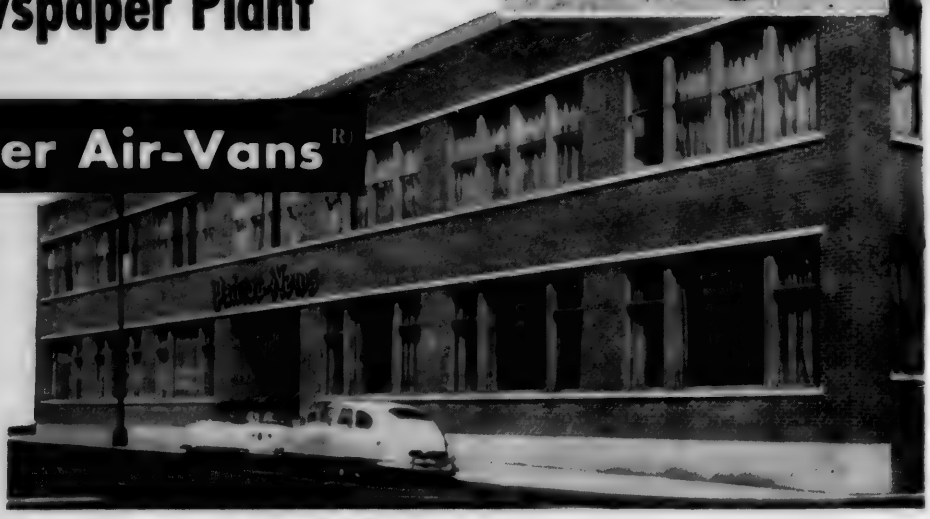
AUTOMATIC CONTROLS for DOMESTIC HEATING • AIR CONDITIONING • REFRIGERATION • AVIATION • TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES

Plant machinist examines Gallaher Air-Van® on roof of Patriot News Building Harrisburg, Pennsylvania

Positive Removal of Heat and Fumes from a Newspaper Plant

by Gallaher Air-Vans®



WHEN there is a stereotype pot capable of melting nine tons of metal at one time, an architect must be sure of the ventilation he specifies to do the massive job of removing heat, fumes and smoke.

That's why Gallaher Air-Vans® were specified for this particular job at the Patriot News Building at Harrisburg, Pennsylvania, and for other ventilation tasks about the several million dollar installation. Gallaher Air-Vans® remove ink mist and other fumes from the giant press, exchange the air in photographic dark rooms and above the linotype machines.

Is the Gallaher equipment doing the job? Well, as one plant official puts it, "The air is as clean as a well-kept Pennsylvania Dutch home."

Maintenance? Just routine. Rugged construction pays off.

Just one more example of why it pays to specify Gallaher where positive air removal is essential. The patented built-in scroll effect design and air seal-off, low noise levels, low installed silhouette, availability in special metals, and weatherproof design are all features that have made Gallaher a recognized leader in the field of industrial ventilation.

Direct Drive units: 150-11,000 CFM. Belt Drive: 3500-65,000 CFM, developing static pressures to 4".

For further information write

Patents 2188741 2526290
Patents pending

The GALLAHER *Company*

Pioneers in Research-Designed Power Roof Exhausters

4108 DODGE ST. **OMAHA, NEBRASKA**

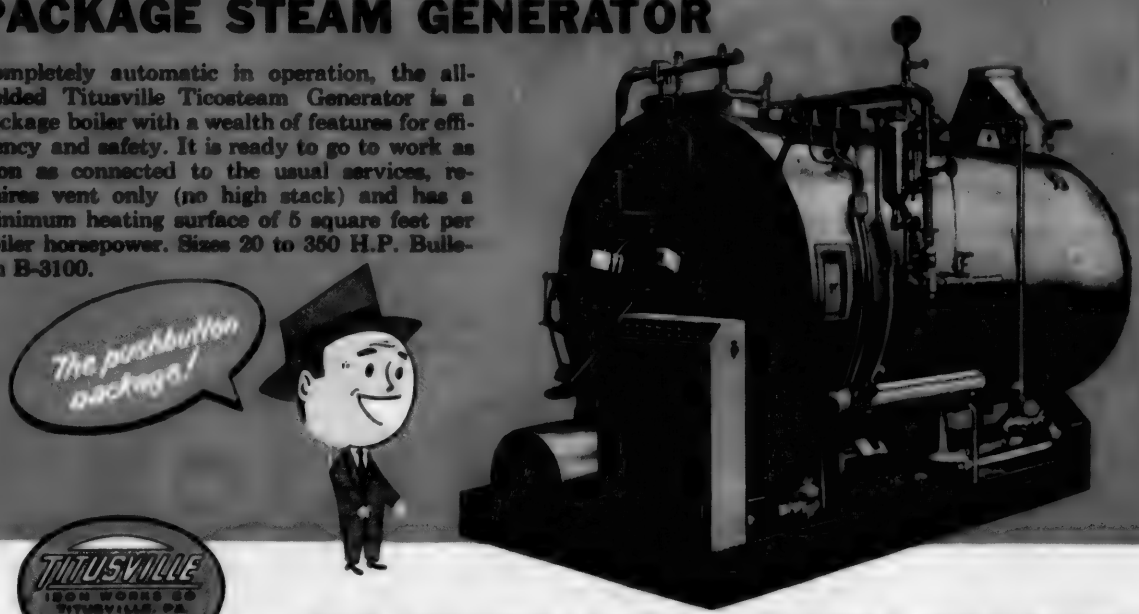
LEADERS IN THEIR FIELD!

TITUSVILLE TYPE WP FIREBOX BOILER

Precision die formed, fusion-welded into a sturdy one-piece unit, this popular Titusville boiler remains tight and leakproof under all operating conditions. Low fuel consumption, low maintenance and high efficiency make the WP first choice in firebox type high pressure boilers. 12 sizes, 250 to 2500 sq ft heating surface. Bulletin B-3030.

TITUSVILLE Ticosteam PACKAGE STEAM GENERATOR

Completely automatic in operation, the all-welded Titusville Ticosteam Generator is a package boiler with a wealth of features for efficiency and safety. It is ready to go to work as soon as connected to the usual services, requires vent only (no high stack) and has a minimum heating surface of 5 square feet per boiler horsepower. Sizes 20 to 350 H.P. Bulletin B-3100.



TITUSVILLE IRON WORKS CO. TITUSVILLE, PA.

A division of Struthers Wells

THE TITUSVILLE IRON WORKS COMPANY

TITUSVILLE, PENNSYLVANIA

***Manufacturers of* A Complete Line of Boilers for Every Heating and Power Requirement**

How to Select an Economical Temperature Regulator

First of all, what does economy mean where temperature regulators are concerned? In some industries it means improvement of product or reduction of spoilage through closer control of process temperatures. In others, it means the paring down of operating expense. The price of the regulator itself is a relatively small factor.

Today's buyers are shopping for:

1. Accuracy of control — not only when the regulator is new, but throughout its service life
2. Dependability — to prevent loss of production time
3. Minimum installation and maintenance cost

Here are a few tips on what to look for when you're installing a new or replacing an old temperature regulator —

Packless construction . . . and for this reason: A diaphragm operated, packless regulator minimizes friction. There are no closely fitted parts to stick or bind because of uneven expansion or collection of foreign matter. Also, there's less maintenance, since no repacking is ever required.

A guarantee against wire drawing of the seats and discs. Insist on it. This guarantee in combination with single seat design assures you of tight shutoff; you avoid expensive steam losses as well as loss of product in a process application.

Broad control range. In a standard regulator you should expect a control range of 100 F. And make sure the unit you select has a vapor tension thermostat that can take over-temperatures of at least 100 F.

Easy maintenance. Why ask for grief? Your temperature regulator should be basically simple in design so that it can be serviced by average plant personnel. All parts should be readily accessible for testing and cleaning.

Double duty. There's no point in buying a separate pressure regulator when you can select a temperature regulator that combines both temperature and pressure control within the same unit.

Self-operating. Make sure you get a regulator that operates on its own initial pressure. By doing so, you avoid the purchasing and maintenance of an air compressor plus air piping, and you're sure of uninterrupted operation during electric power failures.

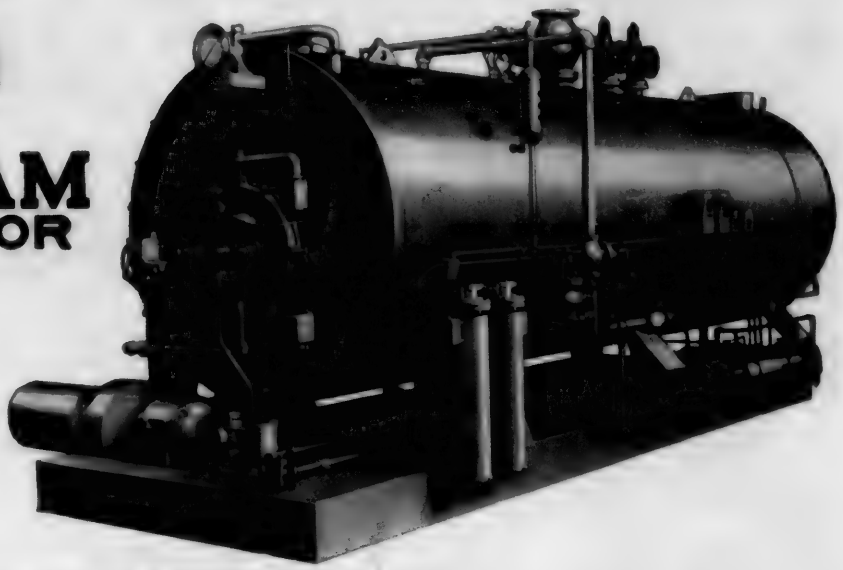
• • • •

All of these points are important to you when it comes to selecting an economical temperature regulator. Perhaps you didn't realize you could expect so much. And perhaps you didn't realize that Spence Temperature Regulators offer all these features and more. May we send you our Bulletin T500 containing further details? SE 128

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

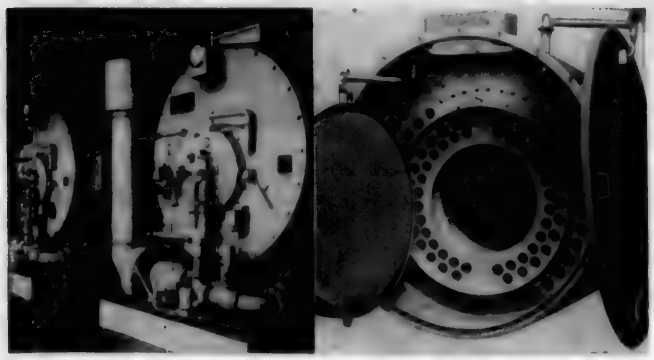
GET ALL THESE ADVANTAGES

WITH AN AMESTEAM GENERATOR



For:
PROCESSING
HEAT — POWER

20 sizes, 10 to 600 H.P., 15 to 200# W.P., oil, gas or oil-gas combinations with quick fuel switchover feature.



FULLY ASSEMBLED

All piping, wiring and operating parts completely assembled and tested at factory — units shipped in ready-to-fire condition!

EASY TO CLEAN

Ames-designed davit hinged flue covers and baffle provide quick and complete access to the furnace and all tubes.

SAVINGS IN FIRST COST!

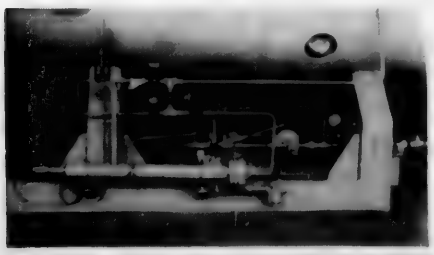
Your purchase price includes complete unit — no hidden "extras" to buy later on!

SAVINGS AT INSTALLATIONS

Just set on level concrete floor, connect to service lines and breeching. Nothing to assemble. No brick work required.

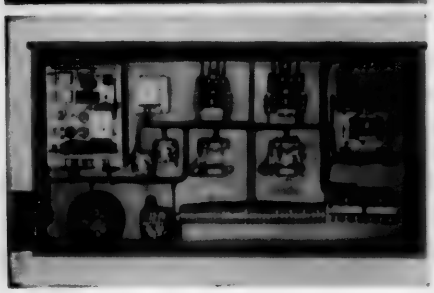
SAVINGS IN OPERATION

A minimum of supervision — lower manhour requirements for maintenance — easily replaced inexpensive plastic refractories — 80% thermal efficiency.



AMPLE ROOM

underneath for servicing auxiliary equipment. Control panel at eye level.



AUTOMATIC

operation, fully safeguarded, is provided by factory installed and tested control system.

Write for bulletin today!

AMES IRON WORKS, INC.
Oswego, N. Y. Box C-105

Gentlemen:

Please send me further information on AMESTEAM GENERATORS and name of nearest representative.

NAME.....

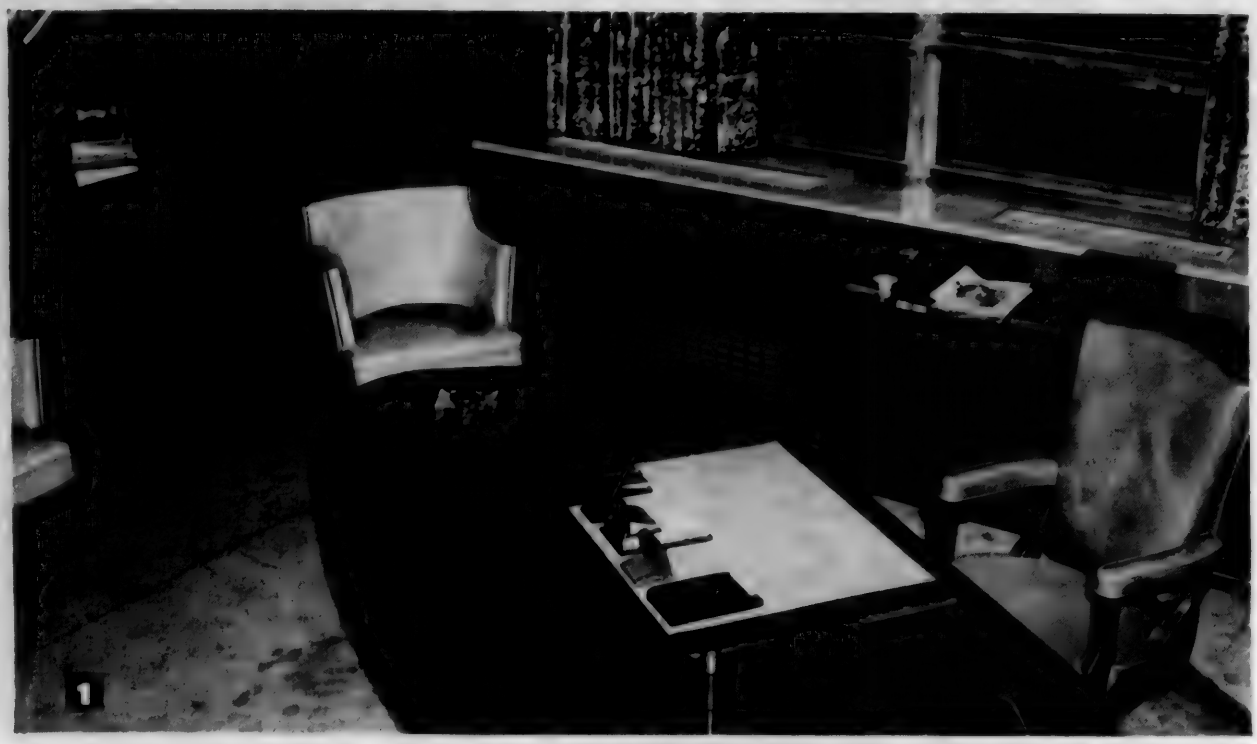
COMPANY.....

ADDRESS.....

AMES IRON WORKS INC.

BOX C-105 OSWEGO, N. Y.

For heating or ventilating new or existing offices, stores, schools or public buildings



Modine Cabinet Units—

so efficient, so versatile, so practical

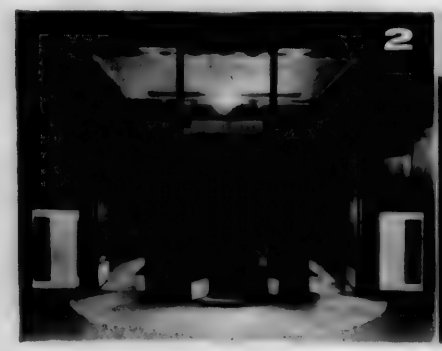
NOTHING can match the performance, flexibility and economy of a Modine Cabinet Unit when it comes to heating, cooling and ventilating. It's the modern way to year 'round comfort yet costs less to install than a unit ventilator. Recessed in the wall or concealed behind a partition or false ceiling to conserve space, a Modine Cabinet Unit provides quick, positive, quiet distribution of warm or cool air for rooms, entrances and corridors of all sizes.

Choose from five models—120 to 640 Edr. Some heat with hot water, cool with chilled water . . . others use hot water or steam for heating only. Find out how one smartly-styled Modine Cabinet Unit can do the job of two or three old-fashioned, unsightly radiators—do it better for less. Call the Modine representative listed in your classified phone book or write for Bulletin 552—Modine Manufacturing Co., 1511 DeKoven Ave., Racine, Wis.

1. Impressive modern executive office uses completely concealed Type FT cabinet unit.
2. Entrance way of large department store has two Type FE cabinet units.
2. School hallway features recessed Type BT unit with plenum base.
4. Airport promenade utilizes Type BF cabinet units with plenum base.

Modine
CABINET UNITS

C-1281



NEW!

EASY-HANDLE CARTON . . .

for the famous easy-handling Chase Copper Water Tube!

What a combination! Top-quality Chase copper water tube in a new carton that's *more convenient than ever*. It's easier to carry, easier to identify, easier to store compactly!

Square hole in carton's middle is a secure finger or arm grip. All information is clearly printed in *big*, INDUSTRY-APPROVED, COLOR-CODED LETTERING—on top, bottom and sides. Type L is blue-coded; Type K, green-coded. Carton can be rolled easily, yet stands on end steady as a rock. And the rugged one-piece construction of the carton completely protects the 60-foot coils of Chase copper water tube from damage!

You get *this* tube clean, bright and perfectly tempered for easy hand bending. Whether you use it with Chase Solder-joint or flared fittings, you can count on permanently leak-free joints—and a better job every time.

All Chase wholesalers will soon have green-coded Type K and blue-coded Type L copper water tube in the *new easy-handle carton*—in the sizes you need.

SEE NEXT PAGE

Chase

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

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Atlanta	Cincinnati	Grand Rapids†	Louisville†	New York	St. Louis
Baltimore	Cleveland	Houston	Milwaukee	Philadelphia	San Francisco
Boston	Dallas	Indianapolis	Minneapolis	Pittsburgh	Seattle
Charlotte†	Denver	Kansas City, Mo.	Newark	Providence	Waterbury

Ask for Chase® Copper Water Tube in NEW COLOR-CODED CARTONS!

WHOLESALERS! CONTRACTORS!

You save time handling Chase copper water tube in its compact package. For in addition to being *easy to handle*, Chase's unique marking with the industry-approved COLOR-CODING makes the cartons EASY TO IDENTIFY, TOO! You can distinguish between blue-coded Chase Type L or green-coded Chase Type K cartons in a jiffy—even in dim light!

TYPE L SOFT TEMPER CHASE COPPER WATER TUBE
in BLUE-CODED CARTON

Ideal for radiant heating and general plumbing purposes, with solder-joint and flared fittings. Available in cartons in 60-foot coils—¼"-⅜"-½"-¾"-1" diameters.

TYPE K SOFT TEMPER CHASE COPPER WATER TUBE
in GREEN-CODED CARTON

Best compromise between high corrosion resistance and low cost. For house replacements, underground service lines, oil burner work. Available in cartons in 60-foot coils—¼"-⅜"-½"-¾"-1" diameters.

Chase®

BRASS & COPPER CO.

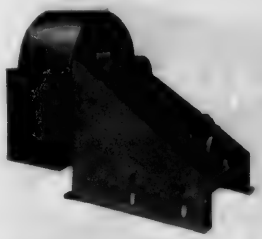
WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

All Chase® Wholesalers will soon have Types K and L Copper Water Tube in the new easy-handle carton. Order from them today!

The Nation's Headquarters for Brass & Copper

Albany† • Atlanta • Baltimore • Boston • Charlotte† • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Grand Rapids† • Houston • Indianapolis • Kansas City, Mo. • Los Angeles
Louisville† • Milwaukee • Minneapolis • Newark • New Orleans • New York • Philadelphia • Pittsburgh • Providence • Rochester† • St. Louis • San Francisco • Seattle • Waterbury • (†sales office only)

nyb

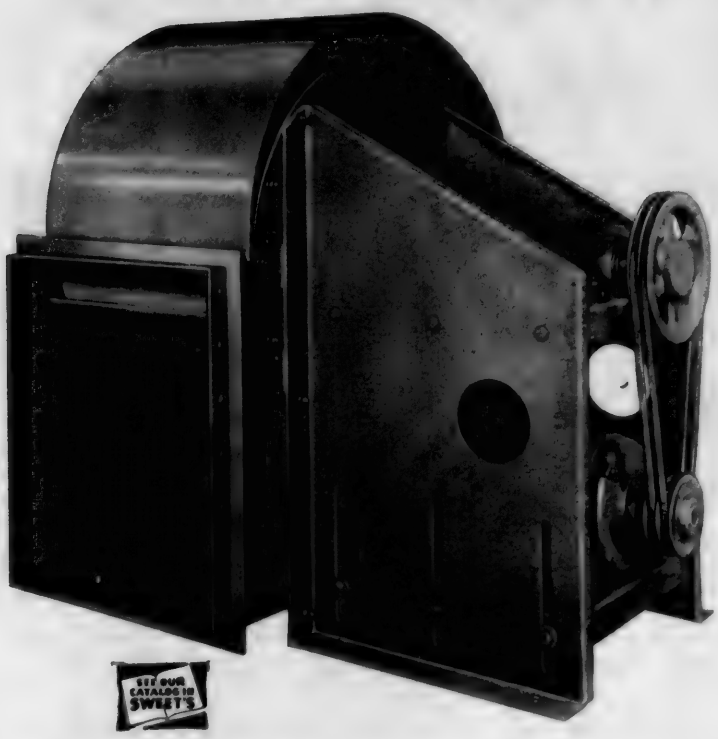


Nos. 76 and 91
Belted
Junior Fan

GENERAL PURPOSE FANS

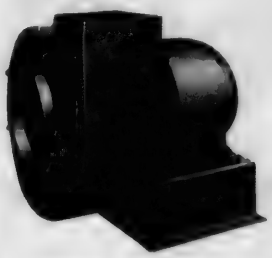
Recommended for their ease of installation,

low maintenance cost and space saving features.



Portable, self-contained units of medium capacities for low pressure industrial and ventilating applications. Designed particularly for use with duct systems.

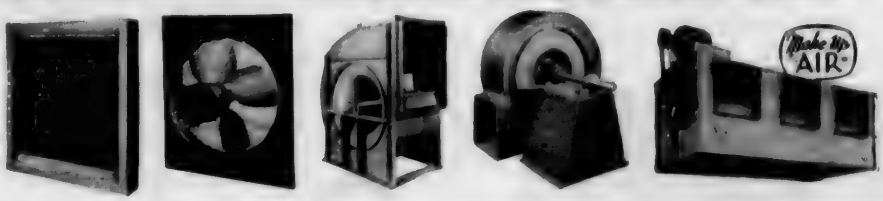
General Purpose Fans are made in three types and eight basic sizes with capacities from 1200 to 19,000 cfm. (Junior fans in five sizes from 160 to 4100 cfm). These include both direct connected and belt driven models.



No. 10 G. I.
Industrial Fan

with manganese bronze wheel, spark proof and acid resistant. For use in hazardous locations where explosive air mixtures are to be handled, and for handling hot gases and conveying materials in process. Two arrangements, two types of wheels. All fans reversible. Speeds up to 4500 rpm. For temperatures up to 350°.

nyb products have 65 years of manufacturing experience and engineering knowledge built into them. All **nyb** products are laboratory tested, accurately rated and fully guaranteed in strict accordance with standard test codes.



When working on your air handling problems, consult the *nyb* representative nearest you in our nationwide service or write for bulletins.

CERTIFIED RATINGS
NAFM

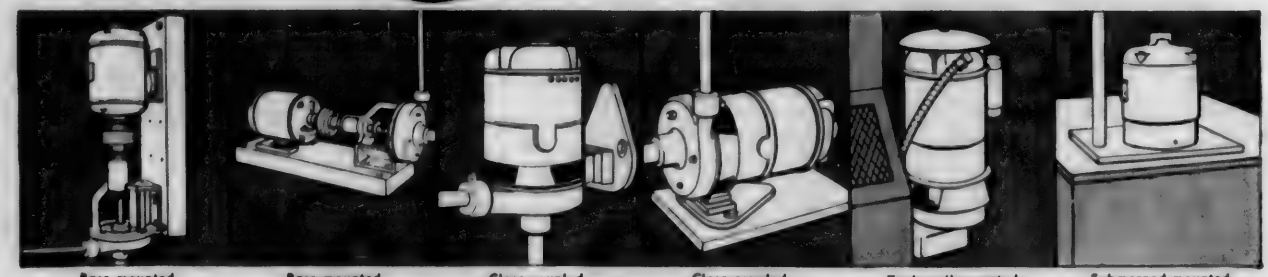
nyb

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 3165 SOUTH SHIELDS AVENUE • CHICAGO 16
FACTORY, LAPORTE, INDIANA

ALLIS-CHALMERS
Air Conditioning
PUMPS

One Pump ...6 Mounting Methods



Base mounted, vertical | Base mounted, horizontal | Close-coupled, vertically mounted | Close-coupled, horizontally mounted | Tank wall mounted | Submerged mounted

makes easier installation for you

YOU CAN SOLVE MANY DIFFICULT INSTALLATION problems by using Allis-Chalmers air conditioning pumps. You can get a single set of operating characteristics using four different models that can be installed in any of six different ways. You can choose the mounting method easiest for your job without having to figure a different pump each time.

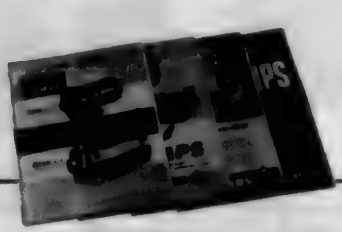
Engineering Assistance

Your Allis-Chalmers representative or distributor is an experienced, highly qualified specialist who will give you full cooperation every step of the way. He'll help you pre-engineer the setup. Many times he can make valuable suggestions which will result in a simpler, more effective installation.

Delivery from Convenient Stock

Allis-Chalmers air conditioning pumps in a wide range of types and sizes are carried in stock by Regional Warehouses and Authorized Distributors throughout the country. A-4577

Electrifugal is an Allis-Chalmers trademark.



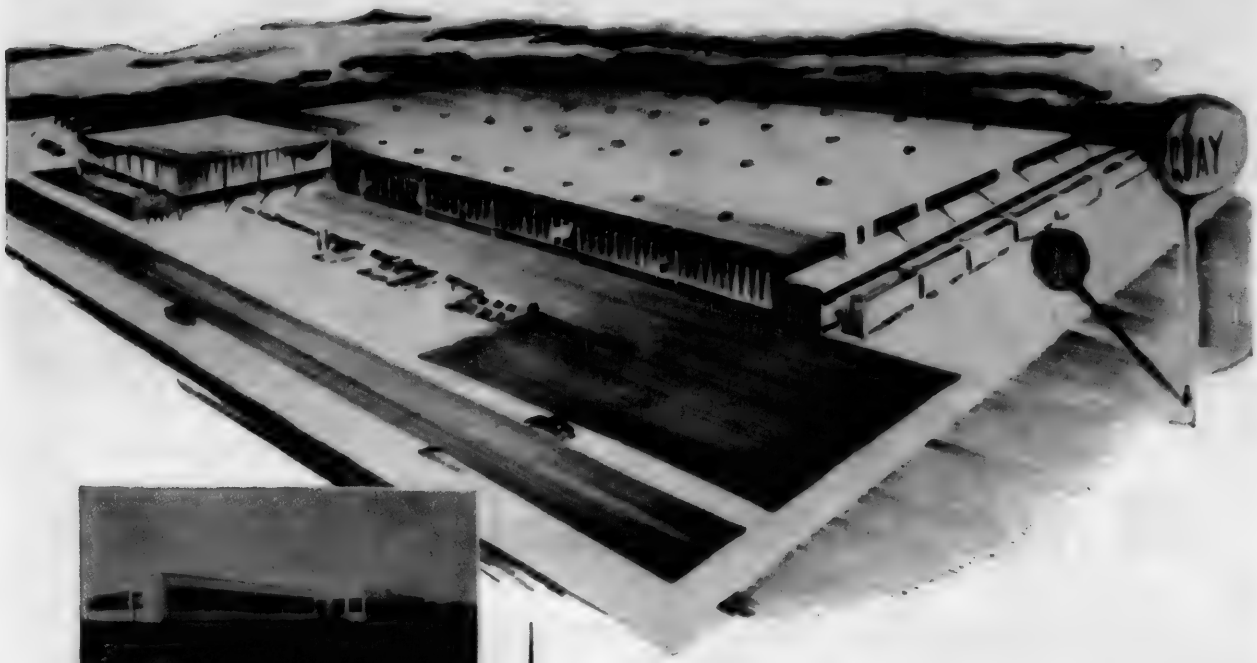
For literature on Allis-Chalmers Air Conditioning Pump (FHP) get Bulletin 5287529 . . . *Electrifugal* Pumps, Bulletin 5286083 . . . Small Vertical Pumps, Bulletin 5286975 . . . Base Mounted Pumps, 5286691. Write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

McQuay...

announces opening of its new plant in Grenada, Mississippi



Faribault Plant
4th St. and Park Ave.
Faribault, Minnesota

General Offices and Warehouse
1600 Broadway St. N.E.
Minneapolis, Minnesota

You're invited to attend our formal opening on October 3

In the 167,000 square feet of space in our new Grenada, Mississippi, plant we have installed the most up-to-date machinery and equipment known to the industry. A large part of McQuay's Heating, Air Conditioning, and Refrigeration Coils as well as unitary equipment will be made here.

These new facilities enable us to offer you faster, more efficient service in the manufacture and distribution of the high quality products for which the name McQuay is so well and favorably known throughout the country.

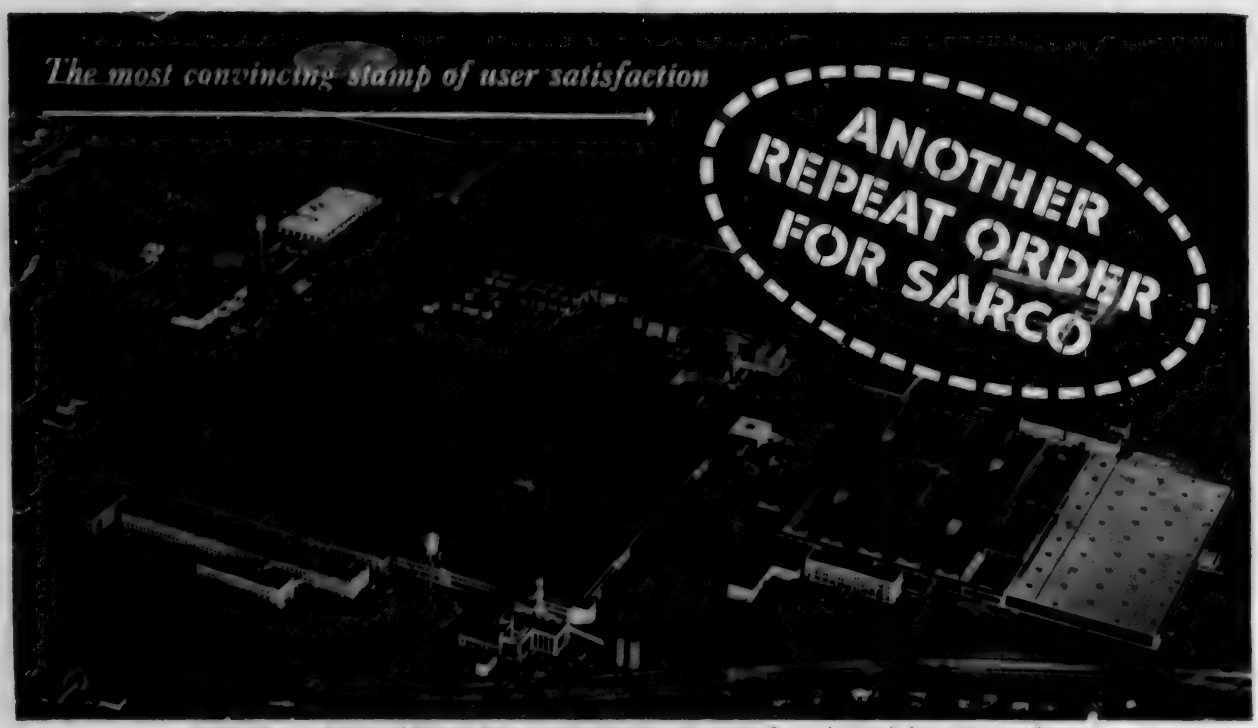
Mark it down on your calendar now, October 3, for a visit we know you'll find a pleasant and profitable experience. Dedication ceremonies will commence at 2:45 P.M.

Write McQuay Inc. for engineering assistance on any coil problem.

McQuay INC.

AIR CONDITIONING
REFRIGERATION
HEATING

1619 Broadway St. N. E., Minneapolis 13, Minnesota



Main offices and plant of Pratt & Whitney Aircraft, East Hartford, Conn., in which Sarco Heating Specialties are installed. These Sarco products are used by all divisions of United Aircraft Corporation.

35 repeat orders from United Aircraft

for Sarco Heating Specialties!

First installation in 1933. Thirty-five installations since. That's the 22-year record of Sarco Heating Specialties in plants and office buildings of all United Aircraft Divisions.

35 *large* repeat orders... won by Sarco proved dependability!

Several thousand Sarco steam traps and other Sarco Heating Specialties are on the job at:

***Pratt & Whitney Aircraft Div.*, East Hartford, North Haven and Southington, Conn., *Hamilton Standard Division*, Windsor Locks, Conn., *Sikorsky Aircraft Division*, Bridgeport and Stratford, Conn.**

For further information on Sarco heating specialties, Sarcotherm weather-compensated control systems for steam and hot water heating, and Sarcofin finned-tube and baseboard radiation, write Sarco Company, Inc., Empire State Building, New York 1, N. Y.

SARCOfin Radiation

...another Sarco product

APPROVED RATINGS—by Institute of Boiler and Radiator Manufacturers for finned-tube and baseboard radiation.

1-YEAR GUARANTEE against defects in materials and workmanship.

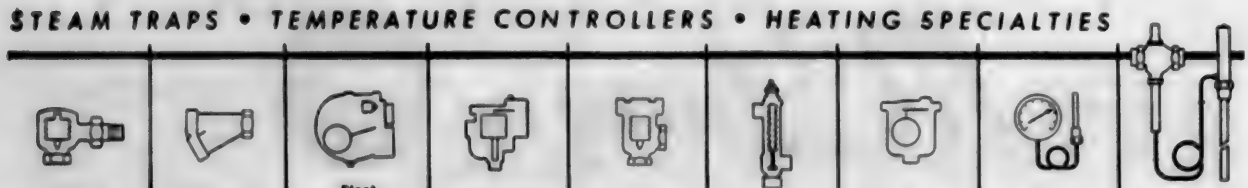
COOPERATION—careful selection of radiation by experienced Sarco and Sarcotherm heating engineers.

Write for Bulletins

SARCO

Sarco quality assures satisfaction

STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES



The following list is typical of the process industries served by

SUPERIOR STEAM GENERATORS

ALCOHOL
ARTIFICIAL LEATHER
CEMENT
CERAMICS
CHEMICALS
COAL TAR PRODUCTS
ELECTRODES
FOOD PRODUCTS
GLASS
LINOLEUM
PAINT AND VARNISH
PETROLEUM
PROVISIONS
PULP and PAPER
RUBBER
SOAP
SUGAR REFINING
VEGETABLE and MINERAL OILS
WATER GAS
WOOD CHEMICALS

18 sizes from 20 to 600 b.h.p. and for pressures to 250 p.s.i. For complete details write today for Catalog 719

STEAM

at the POINT OF USE

cuts costs for process industries

To provide high quality process steam for widely separated operations, many processing plants are installing completely packaged Superior Steam Generators at, or close to the point where steam is used. These highly efficient and compact units may be set up on any floor capable of supporting their weight, connected to service supply and fuel lines, and put into operation within 24 hours of delivery.

Put a *PACKAGED PLANT* in your picture

Avoid the trouble and expense of inefficient long steam lines by installing completely packaged Superior Steam Generators at the point of steam consumption. Superior Steam Generators are fully automatic, burning oil, gas, or both in combination; and are guaranteed to operate at thermal efficiencies in excess of 80%.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS

Fabulous 40 Million dollar Mid-America home of...

PRUDENTIAL

Equipped with Marsh Valves, Traps, Gauges

Skyscraper among skyscrapers, the 40-million dollar Prudential Building stands 44 feet above Chicago's highest rooftop—a giant 400-foot-square edifice containing a million sq. ft. of office space, 30% of it is to be the new "Mid-America Home Office" of Prudential.

It is easy to see why Prudential is building this "Mid-America Home" for Illinois and Indiana when you hear that in the last year Prudential wrote more than 468 millions in policies and paid out 88 millions to beneficiaries in these two states alone. In Illinois and Indiana Prudential now has 4½ *billions* of insurance in force!

The great building is a city in itself . . . with a spectacular restaurant and observation floor at the top, year round air conditioning with personal control in individual offices, and ultra-modern features far too numerous to cover in limited space.

As in so many masterpieces of architecture and construction, Jas. P. Marsh Valves, Traps and Gauges are used exclusively wherever equipment of the Marsh type applies. On that next job see for yourself the dependable performance that has made Marsh heating specialties first choice in finest buildings.

MARSH HEATING EQUIPMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
Dept. U, Skokie, Ill.

Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta

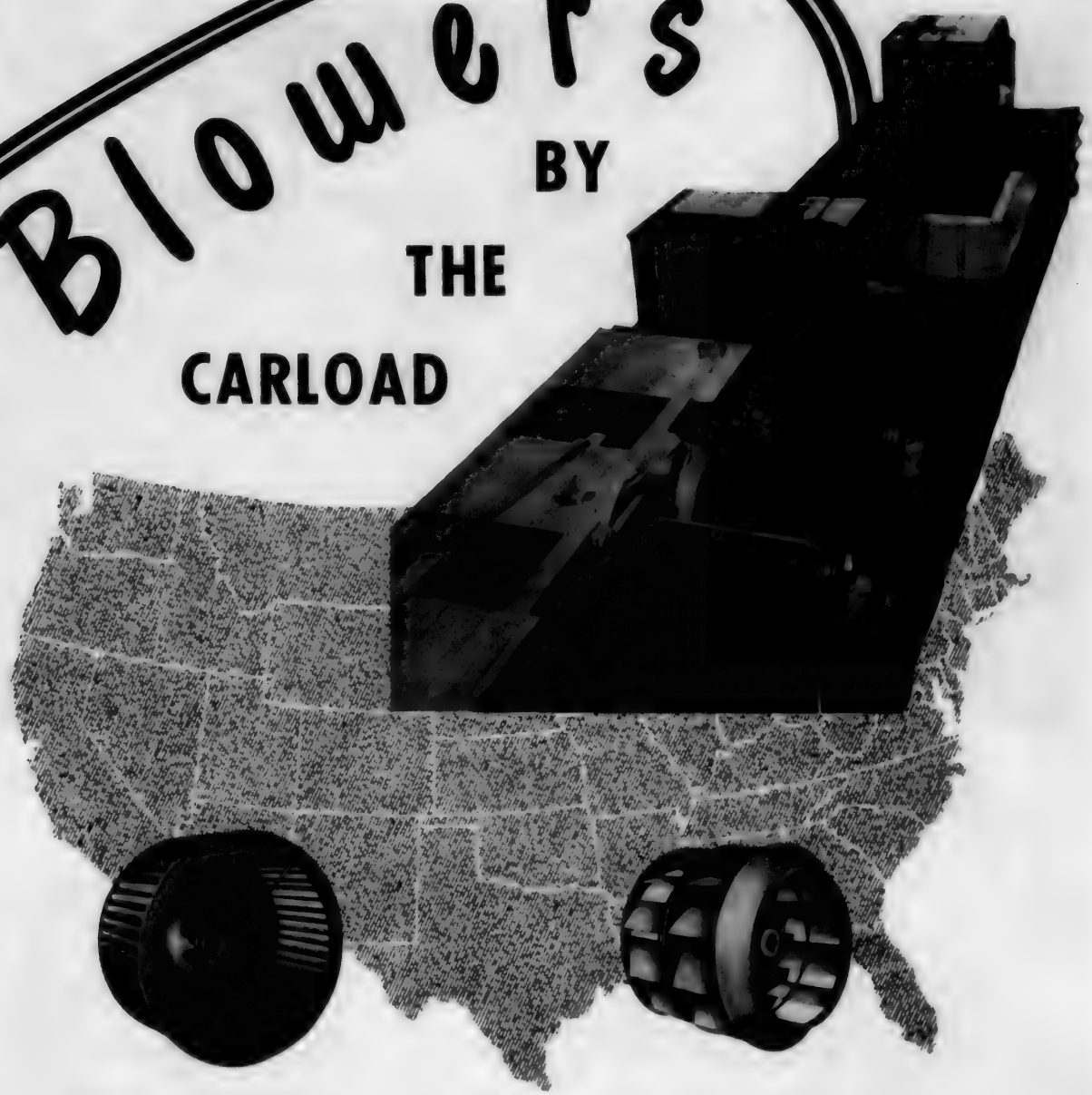
Marsh Radiator Valves and Traps

Marsh Pressure Gauges

Marsh F & T and Float Traps

MARSH *Heating Specialties since 1865*

Blowers BY THE CARLOAD

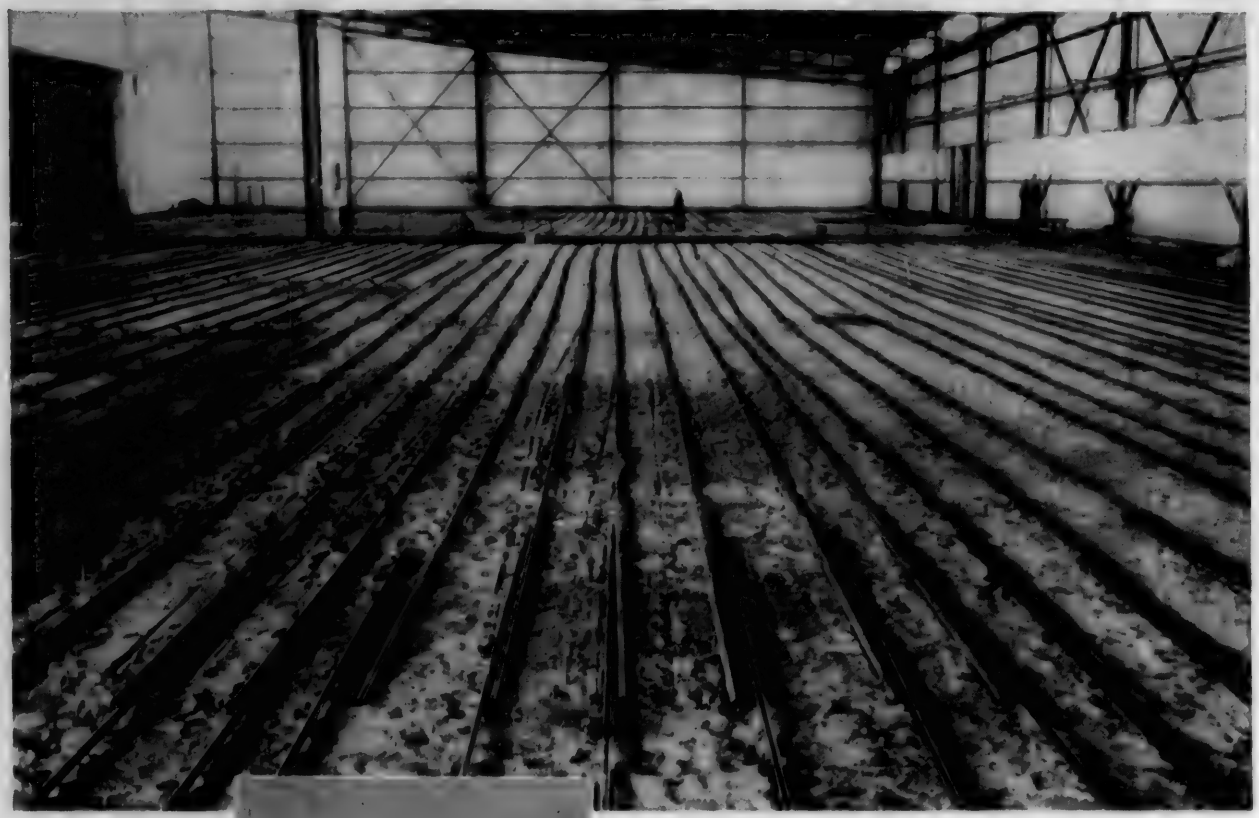


SQUIRREL CAGE TYPE
(Forward Curve Blade)
• Slow Speed
• Extremely Quiet in Operation.
Bulletin No. 101

POWER FIXED TYPE
(Backward Curve Blade)
• Quiet Operation at medium speed.
Bulletin No. 105

The BISHOP & BABCOCK Mfg. Co.

YOUNGSTOWN specified for radiant heating at O'Hare field



Airplane Hanger, O'Hare Field, Chicago, Illinois. Lundstrom & Skubic, Chicago, architects. George J. Ramos Construction Co., Chicago, general contractor. Reliable Heating Co., Park Ridge, heating contractor. Bell & Gossett Co., Morton Grove, heating material.

7 reasons why YOUNGSTOWN PIPE was selected

1. Uniform Ductility
2. Uniform Lengths
3. Uniform Threading
4. Uniform Weldability
5. Uniform Wall Thickness and Size
6. Uniform Strength and Toughness
7. Uniform Roundness and Straightness

Youngstown

QUALITY YOUNGSTOWN SERVICE

Modern radiant heating will be keeping this 52,000 sq. ft. hanger snug when winter winds sweep O'Hare Field in Chicago. Snow, blown in when hanger doors are open, will melt immediately instead of creating a hazardous condition.

Projects such as this are typical of our jet age. And, the fact that Youngstown Pipe was chosen for this heating job is another evidence of its recognized dependability. Made only of the finest steel—its quality closely controlled by one producer from ore mine right through to the final threading operation—the Youngstown Pipe buried in the concrete floor will provide adequate heating service for years to come.

Next time you order pipe, be sure you get YOUNGSTOWN.

HAVING PROBLEMS?

For information and service, get in touch with the local distributor of Youngstown Steel Pipe—or phone our nearest District Sales Office.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices: Youngstown, Ohio District Sales Offices in Principal Cities

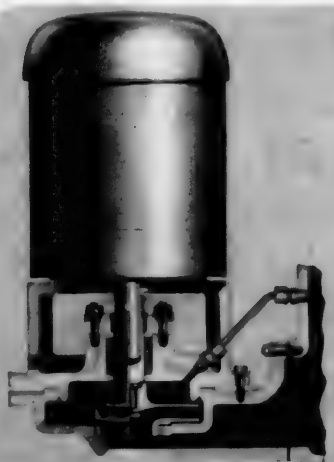
PIPE — STANDARD PIPE — FIRE PIPE — OIL COUNTRY TUBULAR GOODS — CONDUIT ENCASEMENT — MECHANICAL TUBING — COLD-FINISHED BARS — HOT ROLLED BARS — WIRE — HOT ROLLED RODS — TUBE RINGS — ELECTRUNITE — STAYBOLT IRON — BUCK IRON — RAILROAD TRACK SPIKES — MINE ROOF BOLTS

HOFFMAN NEW AND IMPROVED CLOSE-COUPLED CONDENSATION PUMPS

DESIGN FEATURES THAT ASSURE YOU THE MOST MODERN PUMP AVAILABLE

1. Bronze fitted throughout.
2. Enclosed, precision balanced bronze impeller that handles hot water effectively.
3. Stainless steel shaft extension accurately turned and ground with impeller securely locked.
4. Handy drain plug for draining impeller casing.
5. Ball bearing motor made and guaranteed by leading manufacturer 40° C. continuous duty, with ample overload capacity.
6. Heavy rust resisting cast iron receiver.
7. Heavy duty float control with seamless copper float and stainless steel rod.
8. No piping between pump and receiver.
9. Float switch is adjustable for various water levels in receiver.
10. Rigid motor support for quiet operation.

Type "HCS" Single Unit Hoffman Condensation Pump



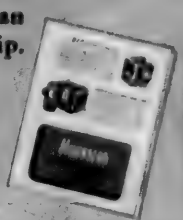
ENCLOSED, PRECISION BALANCED BRONZE IMPELLER ON STAINLESS STEEL SHAFT. PUMP UNIT IS BOLTED DIRECTLY TO WATER TANK.

SINGLE AND DUPLEX UNITS—RATINGS THROUGH 150,000 SQ. FT. E. D. R.

A Compact Pump Combining Dependable Performance with Low Power Cost

The full benefits of rapid condensate removal at low operating cost are yours with this highly efficient, dependable Type "HC" unit. These new, improved pumps are designed to operate at a wide range of pressures without over-loading the motor and are especially adapted for operation at the extremely high temperatures encountered in condensation pump service. All cast iron and bronze construction, they are so designed that parts subject to wear can be easily renewed. All together, these HC Pumps are a typical Hoffman product of sound design and excellent workmanship.

For small systems: "Watchman No. WC-8-20" Pump for low pressure heating systems. Ratings: up to 8000 sq. ft. E.D.R. Pump Capacity: 12 gallons per min. Pressure: 20 lbs. per sq. in. at pump discharge. ⅓ HP standard NEMA motor.



Write today for your copy of this new Hoffman Condensation Pump Catalog.

HOFFMAN SPECIALTY MFG. CORP. • 1700 West 10th Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps — Sold by Leading Wholesalers of Heating and Plumbing Equipment

Duriron Acid Resisting Drain Pipe

DURIRON® generally outlasts the building

Specify DURIRON for *permanent* drain lines to handle acids and other severe corrosives. DURIRON is a high silicon iron that is corrosion resistant throughout. It is not a coating. DURIRON is resistant to practically all commercial acids and many other corrosive solutions.

DURIRON has been proved by many years' service in schools, hospitals, laboratories, kitchens, plating rooms, and in many other applications where the economics of good building call for permanent drain lines.

A complete line of DURIRON bell and spigot pipe and fittings is carried in stock by leading wholesalers in principal cities throughout the country. Write for free bulletin PF/4a or see Sweet's Architectural File.

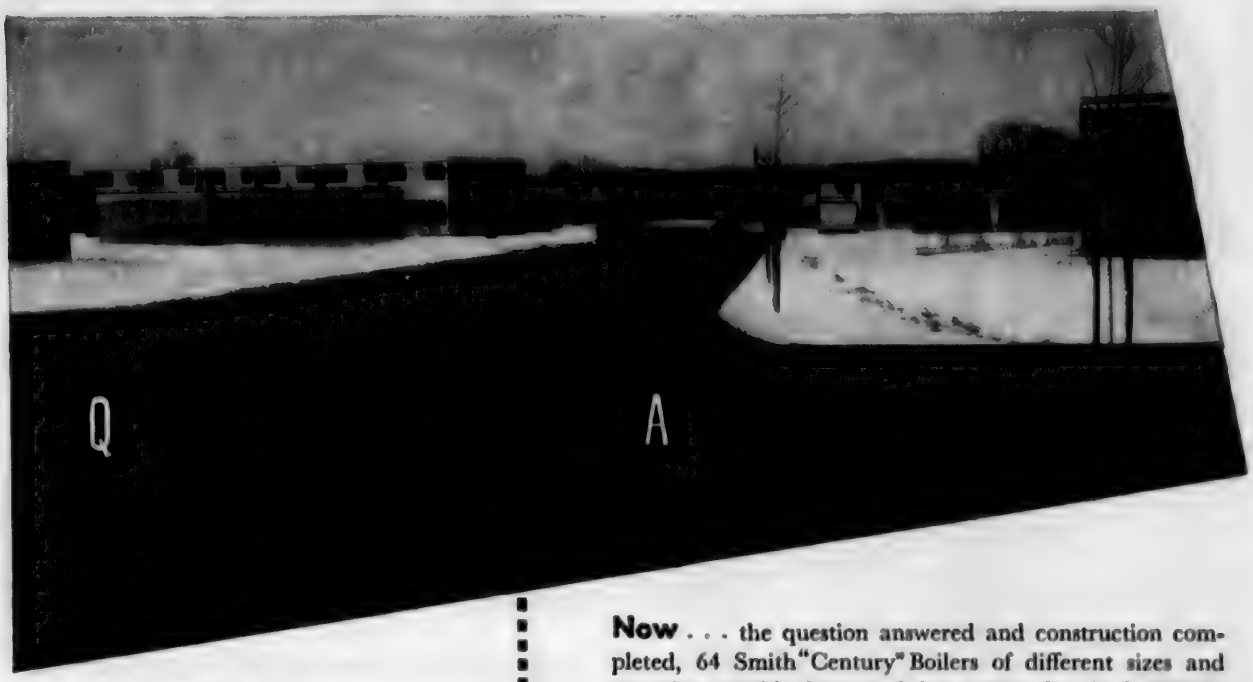
DURIRON is also available with split flange connections for pressure lines. Details are contained in Bulletin PF/2.

THE DURIRON COMPANY, Inc.
DAYTON, OHIO

DURIRON
LOOK FOR THE NAME ON EVERY PIECE

The 64 BOILER Question...

WITH NO QUESTION ABOUT PERFORMANCE



Here are the answers to why Smith "Century" Boilers were chosen over all others.

Now . . . the question answered and construction completed, 64 Smith "Century" Boilers of different sizes and capacity provide heat and hot water for 64 buildings. There is an administration building and 63 apartment buildings with a total of 350 four- and five-room apartments. The Providence Gas Company ran pipelines twelve miles to bring natural gas to this location.

- The Smith "Century" is the only gas boiler available with an integral built-in tankless hot water feature of sufficient size to handle 4- and 5- apartment units. (Most heaters in this project are capable of supplying 8 gallons of water per minute). This domestic hot water feature meant considerable initial savings and subsequent maintenance costs which would have been necessary had separate hot water heaters been used.
- The Smith "Century" is the easiest boiler of its size to service. This is a most important factor since the project management naturally wishes to cut service to a minimum.
- The Smith "Century" is engineered from the ground up for long life and low maintenance. Every part from the stainless steel flue collector to the rugged cast iron burners with precision-drilled raised ports is designed with the utmost of operating efficiency and economy in mind. This is of prime importance in a project of this type.

AGA APPROVED

Input Ratings from 138,000 Btu to 745,500 Btu

Bulletin Free

Completely illustrates and describes the Smith "Century" Gas Boiler

H.B. Smith **CAST IRON BOILERS**

THE H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS *ESTABLISHED 1853*

a big air conditioning job for a big building

1100 MARLO SEAZONAIRES

...TO COMFORT CONDITION SOUTHWESTERN BELL TELEPHONE COMPANY OFFICE BUILDING

Remote Room Units Will Provide Summer Cooling, Winter Heating for 26-story St. Louis Skyscraper.

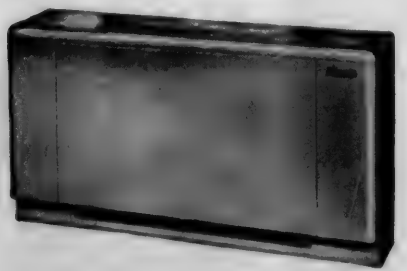
●

One of the largest air conditioning installations ever made in a St. Louis office building, totalling 1800 tons, is under way. By next summer, this structure, the tallest in the city, will be provided with an efficient year-round comfort conditioning system.

Over one thousand Marlo Seazonaire Remote Room Air Conditioning Units will be installed. These versatile, flexible units will permit occupants of each office to regulate temperatures to their own preference.

Engineers on the mammoth installation project are Weil and Moses, New Orleans. Sodemann Heat and Power Co., St. Louis, is the air conditioning contractor.

Write Today for New Bulletin on Marlo Seazonaire Air Conditioning.

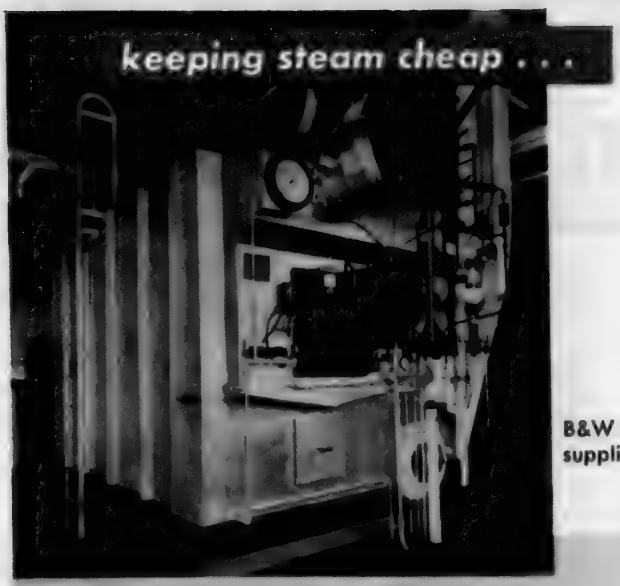


SEE OUR DISPLAY AT THE ALL-INDUSTRY SHOW ATLANTIC CITY NOV. 28–DEC. 1

MARLO coil co.

SAINT LOUIS 10, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925



B&W Integral-Furnace, Type FM Unit which supplies steam for all plant purposes.

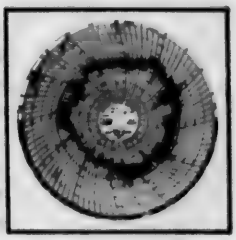
Main plant building of Shulton, Inc.

Engineers: Emil Gruenberg & Associates, N. Y. C.
Architects: Drake, Tuthill, Convery & Cueman Associates Summit, N. J.

B&W FM Boiler Supplies NEW STEAM FOR Old Spice

Production lines are humming at the beautiful Shulton, Inc., plant in Clifton, New Jersey, as this leading toiletries manufacturer hustles to keep pace with the huge and growing demand for its Old Spice and other lines of popular products. Started from scratch less than 20 years ago, Shulton, Inc., now makes its own dies, boxes, packages, and plastic closures for the toiletries which today sell in 28 countries and the United States.

Production on this scale requires a reliable source of economical steam for heating, hot water, and processing operations in the plant's chemical and packaging divisions. When maintenance costs on the two original boilers at the plant began to rise, a B&W FM Unit to provide 15,000 lb of steam per hr at a pressure of 150 psi was installed and went into service last February. The unit burns up to 1600 gallons of #5 oil in 24 hrs., depending upon load. With a return as high as 75%, makeup water required runs between 25 and 50%. Mr. N. J. Fowler, Plant Engineer in charge of Shulton's Clifton operation, declared that "the FM handles wide load swings extremely well and everyone concerned is very happy with the new boiler."



Like Old Spice, B&W FM Boilers are quality products. They have earned a reputation for efficient, economical steam generation for power, processing, and heating in a broad range of industrial, commercial, and institutional applications. Available in standard sizes with individual capacities to 40,000 lb of steam per hr and pressures to 235 psi, many FMs are in service at higher pressures and with moderate superheat. Note the list of cost-saving features typical of this versatile unit.

Write for the detailed description of the FM in Bulletin G-76. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-729

COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Suitable for Outdoor Service
- Safe, Automatic Operation
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space

BABCOCK & WILCOX
BOILER DIVISION

How improved heating helped this hotel clean up....FOUR WAYS

York-Power "Steam-Pak" generators reduced air pollution, saved labor, saved fuel costs, improved service.

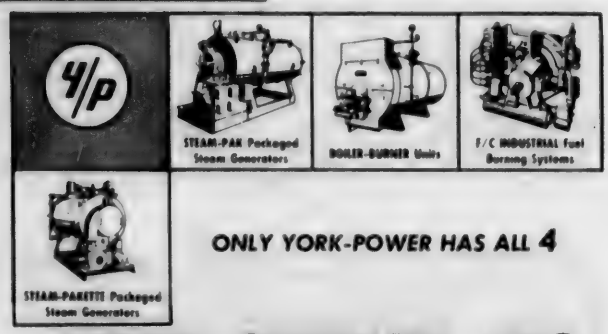
Air pollution by coal dust and ash from coal-fired boilers was a serious problem for the luxurious Marott Hotel in Indianapolis . . . and heating costs kept climbing.

York-Power engineers were called in, and they came up with the answer that saved time and money all along the line.

These engineers specified four York-Power "Steam-Pak" Generators. These oil and gas-fired units supply both hot water and heat for the entire building, as well as process steam for the kitchen cookers, steam tables, and dish washers for 14 dining rooms.

"Fuel savings of 10 to 15% have resulted in the face of increased business" writes Paul Crim, hotel engineer. "In addition the hotel is far easier to keep clean, and we are greatly pleased with the labor savings, heat dependability and uniformity 24 hours a day.

Showing York-Power Steam-Pak generators installed in Marott Hotel. Three at left are 125-hp. low pressure units burning economical No. 6 fuel oil. Far right is 90-hp. high-pressure unit using either No. 6 fuel oil or natural gas.



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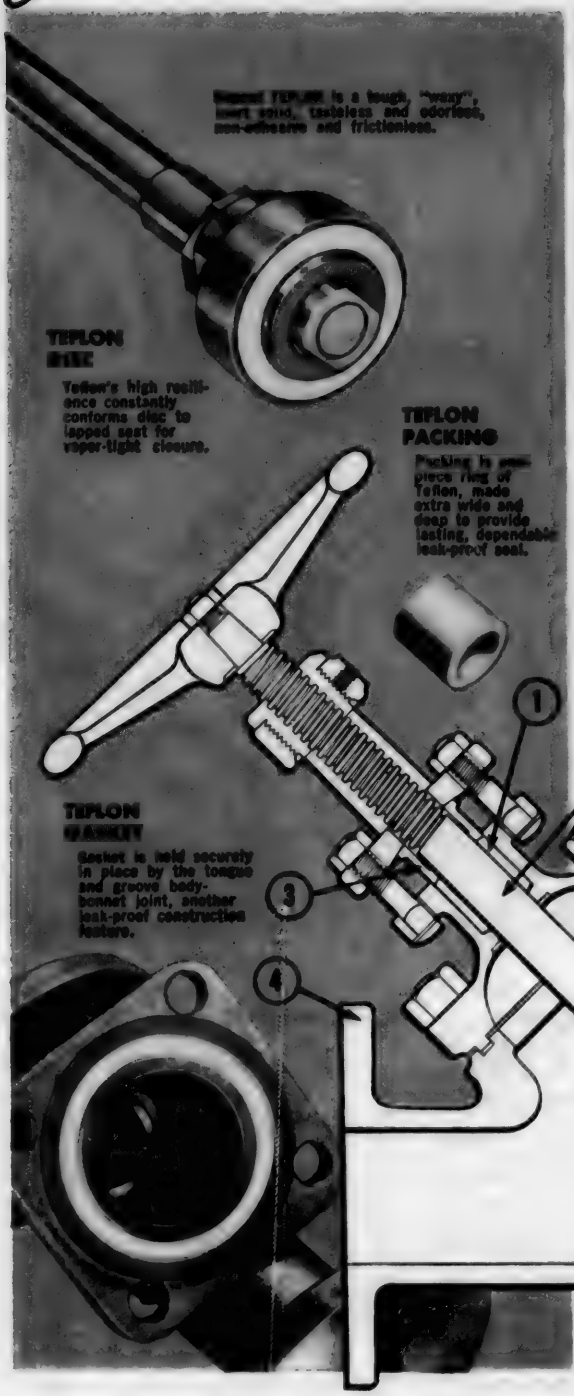
The "Y" pattern permits full flow, nearly equal to that of a gate valve, and also provides the vapor-tight closure and the ease of disc renewal of a globe valve.

Fig. 1335 offers extra value by any test . . . *initial cost, operating efficiency, low maintenance.* You can convert this extra value into *extra savings* on your toughest corrosive services. Call your Jenkins Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17.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Teflon's high resilience constantly conforms disc to lapped seat for vapor-tight closure.
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Packing is one-piece ring of Teflon, made extra wide and deep to provide lasting, dependable leak-proof seal.
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Gasket is held securely in place by the tongue and groove body-bonnet joint, another leak-proof construction feature.
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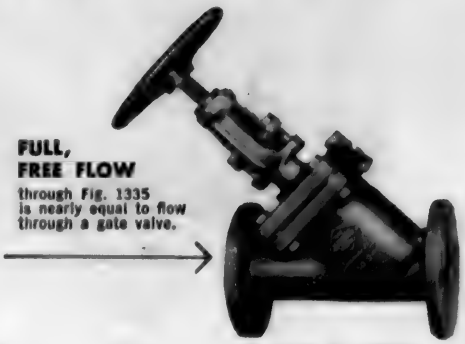

FULL, FREE FLOW through Fig. 1335 is nearly equal to flow through a gate valve.

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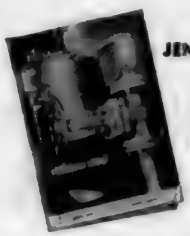

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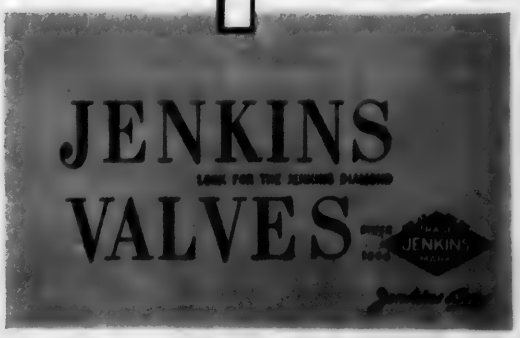

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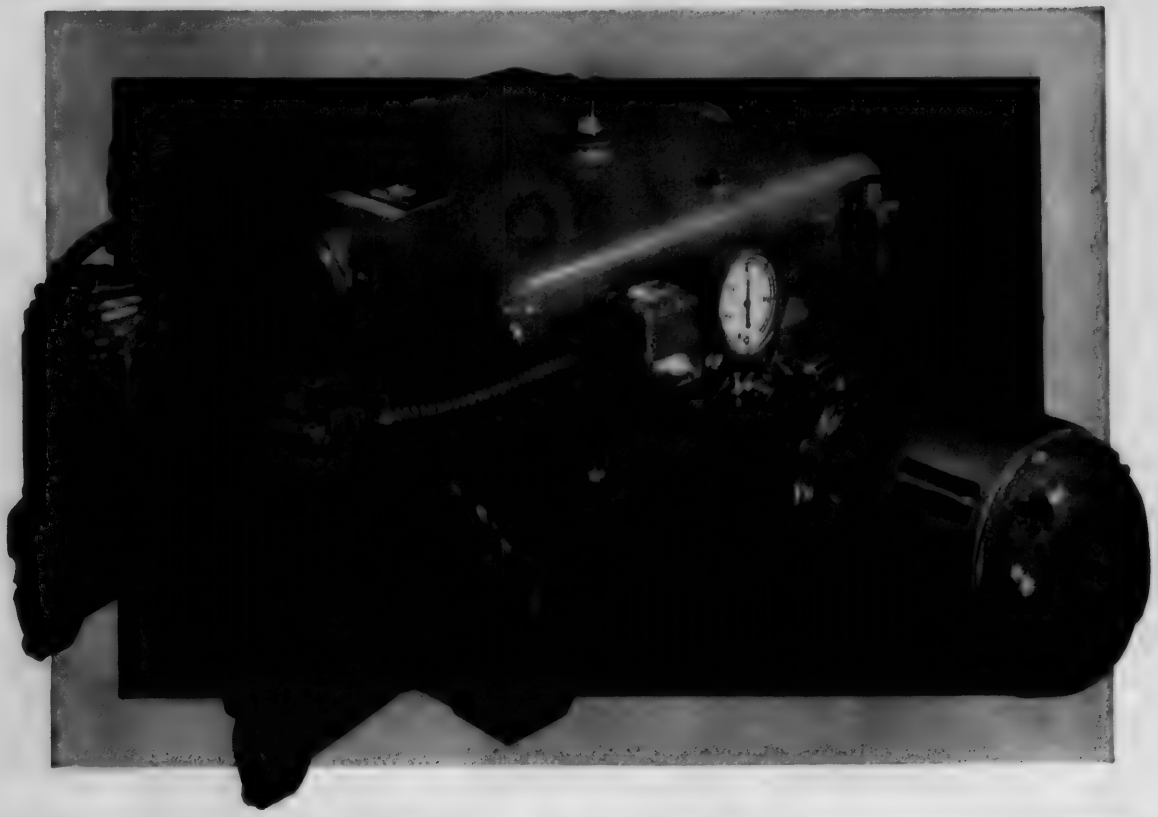

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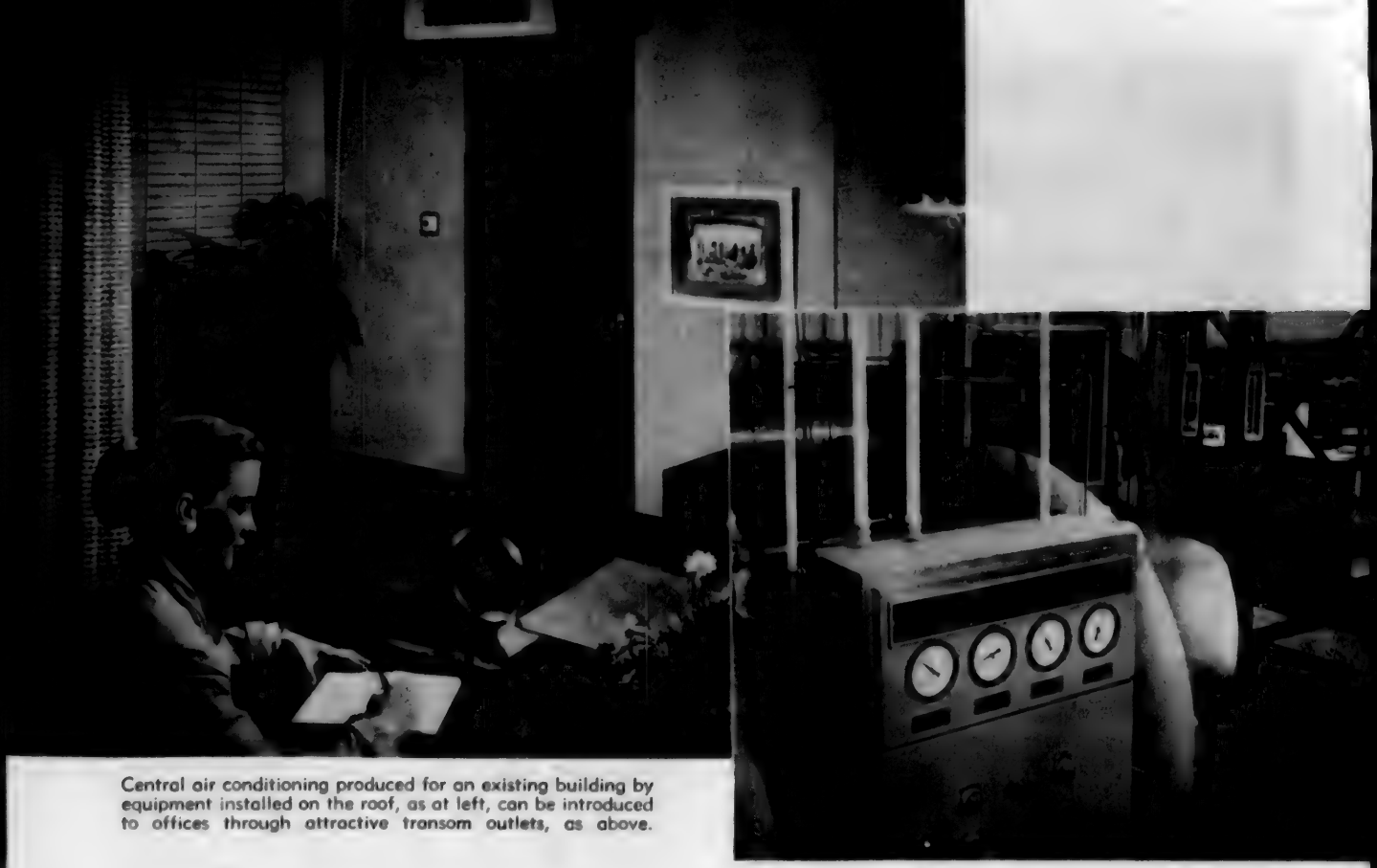

Central air conditioning produced for an existing building by equipment installed on the roof, as at left, can be introduced to offices through attractive transom outlets, as above.

Architectural & Engineering Factors in Air Conditioning Existing Big Buildings

C. L. RINGQUIST

Manager, Air Conditioning Unit Sales Department, The Trane Company, La Crosse, Wis.

Many existing buildings in prime locations are modern in all respects except that they lack air conditioning. Here are the major engineering factors to be considered in restoring the competitive position of such buildings.

ANALYZING a new building for air conditioning is usually not too much of a problem. Slight modification of the construction can usually be made by proper co-operation between the architect and engineer; space can be made available for air conditioning equipment; and proper strength can be incorporated in the construction members to support the weight of the equipment.

This is not the case, however, with existing buildings. Any change in the construction of the building costs money. The air conditioning system must be selected and designed to most nearly meet the existing conditions. In some cases it may be necessary to accept a compromise even though the system finally selected does not fully provide the end results desired. This compromise may be necessary because of cost or because of conditions existing in the building which prevent the installation of the most ideal system.

It is the purpose of this article to discuss in a general way the major factors which must be considered by the architect-engineer in analyzing an existing building for air conditioning. We can divide these factors into six general groups:

(1) Use of the building,
(2) Construction of the building,
(3) Orientation and shape of the building,
(4) Engineering design factors,
(5) Equipment space available,
(6) Factors affecting cost.

Use of the Building

The use to which the building is put or the type of occupancy affects the type and design of the air conditioning system. When there are many small spaces with few occupants per space, the problems are quite different than when there are large spaces with many occupants. A

Fig. 1. Installing centrifugal compressor on a roof.

typical building of the former type is an apartment building. In apartment buildings, the air conditioning system should provide individual apartment control. Any system can therefore be discarded which does not provide individual apartment control, or which recirculates air between apartments, thus transmitting odors and noise from one apartment to the entire building.

Also, since occupancy of apartments varies considerably, the system should provide economy of operation by making it possible to shut off air conditioning in unused apartments. The ideal system, therefore, resolves itself into a small central fan unit for each apartment, supplied with chilled and hot water from a central source, and with small ducts to each room. A further refinement, slightly more costly, would be individual fan-coil air conditioners in each room to give individual room control.

Another similar building is the office building which has a great number of rooms with perhaps one, two, or three occupants per room. One common requirement for an air conditioning system for this type of building is individual office temperature control. Another is extreme flexibility. Large open spaces may be in use at the time the system is designed, but future changes may require individual offices in this same space. The fact that partitions are being changed continually to accommodate new tenants or to accommodate tenants who require additional rooms must also be taken into account.

The design of the system for this type of building, therefore, resolves itself into one of providing individual room units for integrated areas around the perimeter of the building and another system for interior zones—or to provide a system which will approach this arrangement as closely as possible.

Hotels are probably more nearly alike than any other type of multi-story building. They are usually constructed with the rooms on each side of a corridor. Individual room control, preventing noise and odor transmission from one room to another, quiet operation and economy, are of prime importance for air conditioning this type of building.

Frequent partition changes are not a problem in hotels. Once the arrangement of the room has been established, the partitions are seldom changed except for major remodeling. Because of this fact, unit systems are usually used since they satisfy the requirements of individual room control, they prevent noise and odor transmission from room to room, and they provide quietness and economy of operation.

One type of building in which the occupancy is extremely varied is the hospital. Hospitals are probably the most complicated buildings to air condition, largely because of the variety of room types.

Individual room fan-coil units usually work out as the best solution for patient rooms, but in some cases, due to building construction or space restrictions, a small central fan and zone reheat system may be the most satisfactory solution.

Dark rooms, X-ray rooms, nursery rooms, delivery rooms, premature baby rooms, and recovery rooms all require special treatment. Usually an individual unit per room or one unit for a typical group of rooms is most satisfactory.

Operating rooms are, of course, in a class by themselves since they require explosion-proof features and all outside air. The most satisfactory answer for this application is a separate unit or units for each operating room or group of rooms.

Separate remote air handling units with a distributing duct system are usually the best arrangements for the waiting room, auditorium and cafeteria.

Extremely heavy occupancy is present in many buildings such as multi-story department stores or office buildings in which very few private offices are used.

Multi-story department stores are perhaps the only group of buildings which have large open spaces on each floor with no possibility of ever having individual offices throughout the floor. The conventional method of conditioning and one which usually works out satisfactorily is the small central fan type of system with one or more units on each floor.

Occasionally a central fan system is used for the entire building, but this is the exception rather than the rule. Usually, when this arrangement is used, major alterations are required in the building. These alterations may take the form of expensive reinforcing to support a large fan, a new penthouse on the roof to house the fan because basement space is at a premium, and utilizing an elevator shaft for large supply and return air ducts. (Fig. 1.)

Construction of the Building

Unfortunately, most existing buildings were not constructed with the problems of air conditioning in mind.

As far as the exterior wall construction is concerned, the amount of glass area is a critical factor. For every 100 sq ft of unshaded, unfavorably oriented glass used in a tall building in most parts of the United States, about one ton of air conditioning capacity must be provided.

Actually, the solar heat load does not have to be a very large part of the total cooling load to be expensive. It is important because, added to all other loads, it becomes a critical factor since it requires extra refrigeration capacity to meet peak loads that shift during the day through most of the exterior zones of the building.

Windows are the primary means by which solar heat enters the building interior. Sun heat is absorbed through walls also, but the wall load is generally spread more uniformly over the day and thus is not critical in determining air conditioning heat. Solar heat will be discussed further under a later heading.

Another problem in existing buildings is that many of

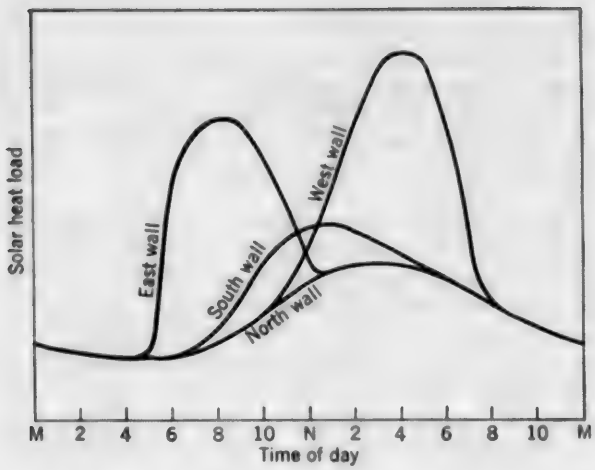

Fig. 2. Pattern of instantaneous solar load on building walls.

them were built of reinforced concrete with columns extended on the outside of the building. This type of construction makes it difficult to install either a unit system or a central fan system. If, based on other considerations, a small central fan system seems desirable, low velocity duct work should first be considered. If low hanging beams interfere, consider high velocity duct work. If ceiling height is still a problem, the possibility of using duct work for ventilation air only, either high or low velocity, should be weighed. If clearance under beams continues to be a problem, a unit system may be the only answer.

However, water risers generally cannot be run close to the outside walls in such a building. This means extra furring and wasted floor space. An alternative is to run lateral supply and return mains near the ceiling of each floor to supply the units in the floor above.

Existing buildings using steel framework construction usually present the same problem as reinforced concrete buildings, as far as running risers and duct work is concerned.

In the majority of cases, a system can be worked out using individual units for temperature control and small ducts from central fan units to supply ventilation and dehumidifying air.

Orientation and Shape of the Building

The location and height of the building, and the surrounding buildings, all influence the type of air conditioning system which may be selected.

Orientation of the building with relation to sunlight is a major factor. As mentioned above, solar heat load can be a critical part of the total load and may strongly influence the type of system selected.

Figure 2 shows how much effect the orientation and shape of the building have on the air conditioning load. From these curves, it can be seen that a building whose largest wall area faces east or west would have a tremendously greater cooling load than either a square building or one with the same shape, facing due south or north.

Solar heat gains are transmitted instantaneously by glass. Peak gains build up sharply and move constantly as the sunlight enters different parts of the building. A building having such variable loads and peaks must always have an elaborately zoned system which permits individual office or room control to allow these changing loads to be overcome as quickly as they develop.

If, on the contrary, a building is entirely shaded by other buildings, it would be adding unnecessary cost to propose an elaborately zoned system which would adjust itself to variations in sun effect.

An interesting point is that particularly in the southern part of the country, a building whose main glass exposure faces south may have a relatively lighter mid-summer air conditioning load with no severe peaks, but in many winter months, its solar gain as a result of the lower sun trajectory may be so much greater that areas along the south wall need cooling, whereas all other areas require heating. This situation, of course, presents some special system design problems.

Buildings located in northern climates are not as easy to air condition on a year-around basis as those in southern climates. For moderate winter conditions, small central fan systems which bring warm air in at a high level and at inside walls may be satisfactory for heating, but where low outside temperatures are encountered, there will be trouble with downdrafts and cold floors unless heating is provided under windows.

The surrounding buildings may determine to some extent the type of system selected. If three sides of a building are entirely enclosed by other buildings, it would be impossible to install a wall intake unit system, even though all the other factors indicated that this system was the most desirable for the job.

Building height will also affect the design of the air conditioning system. Fans must be selected for entirely different static pressures and wall intake units located in top floors of high buildings are not satisfactory because of the higher wind velocities. The stack effect of the building will also affect the type of fans or type of room units selected.

Engineering Design Factors

Two factors to be considered under this heading are: (1) sensible heat percentage and (2) period of occupancy.

Of all the factors affecting the design of an air conditioning system, sensible heat percentage is probably the most important and yet is considered the least. Sensible heat percentage is that portion of the room total heat load which is due to sensible heat. This one factor can be used to a greater advantage to determine the type of air conditioning system required than any other.

In order to use sensible heat percentage for system selection and design, the sensible heat percentage line must be drawn on a psychrometric chart. Figure 3 shows three typical sensible heat percentage lines: 95%, 78% and 60%. Design conditions are assumed to be 80 deg DB and 50% humidity for inside air, 95 deg DB and 46% humidity for outside air.

Since the main source of latent heat is people, a 95% sensible heat percentage indicates that there are relatively few people in the space in proportion to the volume of the room, and little ventilation air will be needed.

From the psychrometric chart, the conditions and quantity of cooling air required to produce room conditions can be determined. The point representing the final dry and wet bulb temperatures of the air leaving the cooling equipment should normally fall either on or below the sensible heat percentage line.

Since a variation in occupancy load between 100% and zero will have little effect except to raise the sensible heat percentage slightly, this variation will not affect the requirements of the system. However, the maximum occupancy, reductions in solar load or transmission heat gains will reduce the sensible heat percentage somewhat, so the system must be able to compensate for this condition.

As long as the point representing the final dry and wet bulb temperature of the air leaving the cooling equipment is properly established, the system can be readily controlled under reduced loads simply by using a bypass damper in the central fan unit or units to enable bypassing recirculated air around the coil. The dry and wet bulb conditions of this air mixture will also fulfill the requirement of being on or below the sensible heat line and therefore will be able to provide the desired room conditions.

The building having 78% sensible heat percentage must have higher occupancy in order to have 22% of its heat gain as latent heat. From the psychrometric chart it is apparent that great reduction in occupant load will make the sensible heat line increase considerably, and under full occupancy, reduction in solar and transmission heat gains will also reduce the sensible heat line even further below 78%.

With such wide variation possible, provisions to produce desired conditions must be made in the system design. It is generally necessary to control temperature and humidity separately, which means that reheat coils must be incorporated in the system. In this way, the condition of the air leaving the cooling equipment may be on the 78% line, and when sensible heat drops below 78%, the air can be reheated as much as necessary to keep room humidity at the desired point.

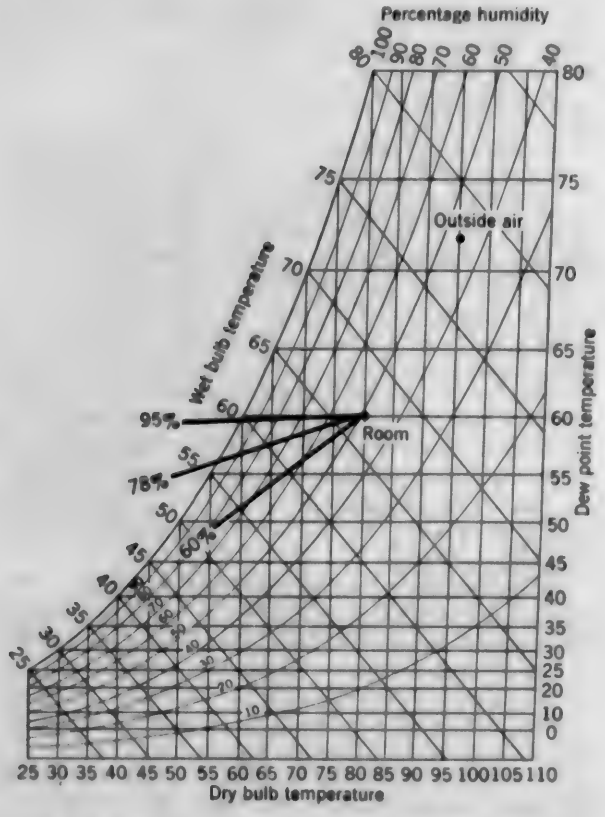

Fig. 3. Effect of sensible heat ratio on cooling load.

Since an all-unit system does not permit independent control of temperature and humidity, it can be discarded as unsatisfactory for this building. Either a small central fan system with reheat coils or a unit system with separate ventilation and dehumidification air supply will be necessary.

A 60% sensible heat percentage usually occurs in department stores, auditoriums, restaurants and perhaps in some interior rooms in hospitals. It indicates a heavily populated area and the first requirement is that a higher proportion of ventilation air is required. However, less *total* air can usually be circulated because the spread between room temperature and the temperature of the air from the cooling equipment is naturally greater.

Control of the system can usually be obtained simply by bypassing air around the cooling coil, since under reduced loads the sensible heat percentage almost always increases, which reduces the humidity control problem.

The same types of systems are usually best for the 60% condition as were recommended for the 78% condition. However, since a low sensible heat percentage means that cooling is often required at lower outside temperatures, the system should be designed to make use of outside air at such times. Central fan units should be located near outside walls in order to effect the economy of using all outside air during certain periods of operation.

The importance of solar load in system design has already been discussed, and the period during which a building is occupied is also important insofar as it may add to the peak loads resulting from the sun. A building may be occupied only during the hours of 9 a.m. and 3:30 p.m., and during this period of time, the load remains fairly constant. If the building is shaded, the system will not have to take great variations in load because the load does not change to any great extent. However, if this period of occupancy is such that it is added on top of the solar load, a system would be required which would be capable of adjusting itself to tremendously wide load variations; reheat coils would no doubt be needed and temperature and humidity would certainly have to be controlled separately. As pointed out previously in connection with solar load, it is probable that a system with fairly elaborate zoning would be required.

Equipment Space Available

Finding space for equipment in an existing building is always a problem. Usually every square foot of floor space is being used and if space is available, it becomes difficult to furnish the necessary power or water supply to that space. Or it may be necessary to tear out some of the existing structure in order to get the equipment into the space.

The necessary refrigeration equipment for large buildings is usually located in the basement or sub-basement. However, it is becoming more and more the practice to locate the refrigeration equipment on the roof or on intermediate floors. When this is done, every consideration must be given to quiet operation, freedom from vibration and building structure strength as well as the other factors of availability of power supply, water supply and the method of getting the equipment into the space to be used.

Supports for the refrigerating equipment are usually

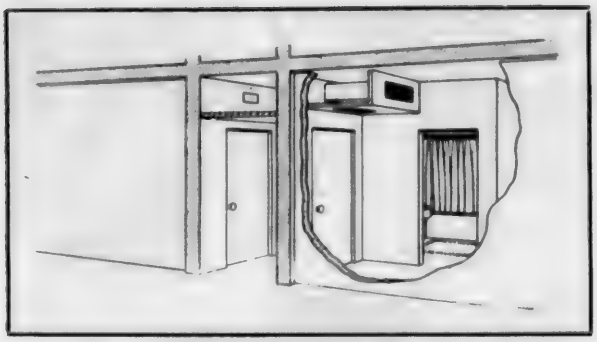

Fig. 4. A possible arrangement for existing hotels.

best supplied by running supporting members between columns because the floors are usually designed for a load of 50 pounds per square foot and this is not strong enough to support large refrigerating equipment. Columns, however, are designed for larger factors of safety and will support the weight of the equipment.

Some thought should also be given to placing refrigeration machines on each floor or on alternate floors so that smaller machines with less weight can be used.

The air conditioning units often present another problem. The manager of a building is usually agreeable to air conditioning the building to hold his tenants, but he is not agreeable to giving up floor space for the air conditioning equipment.

A good procedure to follow for locating equipment is to look for all the possible places that could be used and then by the process of elimination, arrive at the spaces that must be used. For example, the space under the windows should be examined for possible location of unit air conditioners; and low-hanging beams should be checked for possibility of running duct work; the space above the toilet rooms may be usable (these can usually be furred down to accommodate a unit and they are usually located on outside walls so it would be easy to get a supply of outside air); the floor plan should be studied for space that could be used for units but which is of little or no use as far as office space is concerned; pipe shafts should be checked for the possibility of using units on alternate floors and supplying air through ducts run in the shafts or for supplying chilled water risers in these shafts. A possible arrangement for a hotel, using a furred down corridor as a plenum or supply duct is shown in Fig. 4.

If no possible space is available inside of the building, it may be necessary to locate central fan units on the roof and use vertical supply air risers running adjacent to interior columns or in some extreme cases, to provide air shafts on the exterior of the building for the distribution of the air.

Factors Affecting Cost

One of the most important questions to anyone who is considering air conditioning is, "What is it going to cost?" This is a completely separate subject in itself, but brief consideration of some of the factors which will help to reduce cost is appropriate.

One important method of reducing costs on a unit system is to reduce the number of units. Each unit that must be connected adds a definite cost to the original price. It has been the practice of some designers to locate a unit under each window. This, of course, gives excellent coverage, but is costly.

Usually, in a large building, a bay is 24 feet wide and has five windows. That means five units per bay if one unit is located under each window. However, if 24 is divided by five, the quotient is slightly less than five feet. No office is of much use if it is only five feet wide. There's not room enough for even a desk and a chair. The most economical answer is to use three units per bay, sizing each unit to have 2/5 of the capacity necessary for the whole bay. This means two less units to hook up, and the space can be divided into just as many offices with ample air conditioning capacity for each office.

On a large building, this method of reducing the number of units can mean a large saving in original equipment cost and labor for installing the units.

Cost can often be reduced considerably by utilizing existing heating equipment wherever possible. Where the existing heating system is satisfactory, summer air conditioning can often be added simply by running chilled water pipes to small central fan units on each floor or each group of floors.

Another method for reducing costs which is used in many hotels and similar buildings is to use the corridor as a plenum for ventilation air. This saves on duct work and labor for connecting the outside air to each individual room unit. A comparatively recent development is the use of perforated metal ceiling in the corridor for distributing the air along the corridor. This also acts as a furred ceiling to conceal the piping run to the room units which are suspended and furred into the entrance hall to each room.

There are, of course, an infinite number of additional factors which the architect-engineer must consider in designing the air conditioning system for an existing building, including some which may be peculiar to one single building. However, those discussed herein are of primary importance and are common to many buildings.

Hotter Profits from Cooler Livestock

Hogs weighing 200 pounds, which normally gain a pound on four pounds of feed, take a whopping 13 pounds of feed to put on a pound of gain in 85-degree heat. Beef cattle show one-fourth slower gains during hot weather. Dairy cows show a 40% drop in milk production from intense heat, 3% weight loss in five weeks. Heat affects even chickens—production drops one third when inside temperatures go up from 55 to 85 degrees, and eggs are smaller, reports *Farm Journal.*

Shade helps; so does cooler drinking water; but in hot weather, they're not enough. A Georgia hog grower uses one-ton air conditioners at each end of his farrowing house. It takes about $35 per month for electricity, plus depreciation on the cooling units, but he saves more pigs per litter. Two years ago, sows that farrowed in blistering hot weather raised only four pigs each. It turned cooler during the last part of farrowing, and those pigs raised nine pigs. He got the idea and installed air conditioners.

Design and Performance of the Nation's Only Fully Solar-Heated House

RAYMOND W. BLISS JR.

Partner, Donovan and Bliss, Amado, Arizona

Entirely heated by the sun in winter and cooled by night radiation in summer, this privately financed system for an Arizona frame house demonstrates the present engineering and economic status of solar heating and radiation cooling, especially in southwestern states.

WINTER space-heating systems obtaining all or nearly all of the needed heat energy requirements from sunshine have been discussed with enthusiasm for some years, one recent general study even predicting that there may be 13 million installations of this type in homes in the United States by 1975.[1] In view of the inherent economic possibilities, technical study and experimentation in this field of sunshine utilization has been remarkably meager, although an experimental system in which sunshine supplies 50 to 65% of the midwinter heating load to a small house has been in successful operation over the past six years at a northeastern institution.[2]

Apparently, at this writing, the only operating installation in the United States which supplies 100% of the needed space-heating requirements from sunshine alone throughout a normal winter is at a small house in the backwoods of southeastern Arizona. The installation was designed, built, and financed in its entirety by Donovan and Bliss with as little capital outlay as possible with due regard for objectives. However, despite the financial shoestring upon which the construction and research preceding it was done, the system is in no sense a hit-or-miss affair. Six years of study on problems of solar heat collection and allied subjects preceded it. The system was carefully designed to work—and it does work.

This experimental heating and cooling system uses an air-heating solar heat collector, with necessary heat storage being provided by a large insulated bin of loose rock through which air can be circulated. It is not a properly integrated structure of house and collector, circumstances having dictated the very awkward expedient of "bolting on" the system to an existing small house not at all adapted to the purpose. Architecturally and aesthetically the result is best described as a monstrosity. The front cover of this issue and Fig. 2 are views of the equipment installed at the back of the house.

The location is an excellent one for solar heat collection, being at latitude 32 degrees and an elevation of 3,800 feet in a southwestern desert region. Winters are sunny and winter heating loads are moderate but not negligible. The average January temperature is 48 deg F (corresponding to about 530 degree-days per month) but this is variable, and January may have from 400 to 800 degree-days.

[1] Exponent numerals refer to references.

Fig. 1. Rear view of air-heating collector. Fans and control dampers are within the insulated box mounted on roof of the rockpile heat storage unit. Front view is on front cover.

The house (Desert Grassland Station) to which the system is attached is a small, 25-year old, rather dilapidated frame structure belonging to the U. S. Forest Service. Floor area is 672 sq ft. The house has been fairly well insulated, and calculation of the total house heat loss rate by customary methods yielded a calculated loss rate (including air infiltration) of substantially 10,000 Btu per (day) (deg F). The design and sizing of the solar heating system was therefore based on an assumed heating load of 10,000 Btu per degree-day. Later electric heating tests conducted prior to operation of the solar-heating system indicated an actual heat load of more nearly 8,000 Btu per degree-day, hence the solar heating system is probably slightly oversized.

Description of the Heating System

The air-heating solar heat collector is a flat non-focussing type utilizing several layers of black screens to absorb incident sunshine and transfer the resulting heat to the circulating air. Figure 2 illustrates schematically this screen-type collector and the circulation of heated air between collector and heat-storage rockpile. This collector was preceded by a 40 square foot test model, which checked calculations. The present house-heating collector is about 34 feet long and 10 feet high, with an exposed glass area of 315 square feet. It faces south and, since the system is designed to carry the peak midwinter load, the collector is tilted to face the midday sun squarely on January 15th. Although it is rather obviously a good-sized piece of equipment this collector is not so enormous in relation to the house it serves as would first appear, and it

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would fit quite easily into the roof or wall of a properly integrated structure of house and heating system. The collector is faced with ordinary single strength window glass, and back and sides are insulated with reflective type insulation. The four screens, spaced about ¼ inch apart, are of a cheap black cotton cloth similar to cheesecloth. The innermost screen is a more closely woven material than the other three and is used to promote a more even air circulation over the entire face of the collector. Black metal screens would of course be more durable for permanent construction.

The heat storage "rockpile" is roughly 10 by 12 feet on sides and 12 feet deep, with roof about 8 inches above ground level. It is located behind the collector and adjacent to the house, and contains 1,300 cubic feet (about 65 tons) of 4-inch diameter field rock. Three walls of the rockpile are insulated with 7-inch thick insulating concrete, the floor is insulated with about 4 inches of the same material, and there is no insulation on the wall adjacent to the house. The roof is insulated with the equivalent of 8 inches of mineral wool.

Appropriate air circulation to and from collector, rockpile, and house, is produced by two centrifugal fans (one 15-inch diameter with a ½ hp motor and one 10-inch diameter with a ⅓ hp motor) which do not operate simultaneously, two motorized dampers, and an arrangement of ducts, all located within an insulated box installed on the rockpile roof.

The system also includes an automatically controlled and separately metered 6 kw electric resistance heater in the house ducts, with operation so controlled that the system will shift to electric house heating if at any time the house thermostat demands heat and the rockpile is unable to supply air at a temperature of at least 85 deg. This auxiliary heating system is not expected to operate at any time during a normal winter, and has not in fact done so. It is used during occasional chilly mornings in late spring and early fall when the remainder of the system is operating on cooling phase as described in a later paragraph.

For testing purposes the installation has an excellent continuously recording pyrheliometer setup, and a moderate degree of other instrumentation. Electrical consumption of all fans and controls is metered, with a separate meter for the auxiliary heating system. Continuous record of outdoor dry-bulb temperature is maintained, and manually read thermometers are installed for readings of (1) collector supply and return duct air temperatures, (2) indoor or outdoor dry-bulb and wet-bulb temperatures, (3) indoor "register" air temperature, and (4) living room temperature at the 48-inch level. During the past winter heating season most of these thermometers were read on an approximate hourly schedule during daytime hours. It is hoped that some further instrumentation may be added prior to the start of the 1955-56 winter season.

Operation and Performance

All operation of the system is automatic. Solar heat collection is controlled by an outdoor sunshine-responsive thermostat, house heating by a conventional indoor thermostat of the clock-controlled "night cutback" type. When the house thermostat demands heat during periods of solar heat collection the necessary heated air is supplied directly from the collector. During periods of no solar collection house heating is accomplished by circulating air between house and rockpile. House circulation is through conventional (high wall) "registers" in each room. Air circulation through the rockpile is so controlled that when the rockpile is being heated (i. e., collector in operation) air flows upward through the rockpile as indicated in Fig. 2. However, when the rockpile is delivering heat (i.e., house heating from rockpile) the air flow through the rockpile is in the reverse direction, thus ensuring that the house always receives air at the highest available temperature level.

Winter heating performance so far has been excellent. This system was only completed and placed in operation on January 15th, 1955. The first five days of operation were used to heat the rockpile only, with circuits temporarily wired to continue house heating by the auxiliary electric heating system. These first five days were not particularly propitious for the start of a solar heating system, being characterized by two snowstorms, two completely overcast days, and no fully clear days. Nevertheless it was decided to commence solar house heating on the morning of January 20th, at which time the collector was covered with snow (Fig. 3).

The next four days forced the system into an immediate and severe test of performance. The weather was sunny but abnormally cold, the average temperature for the

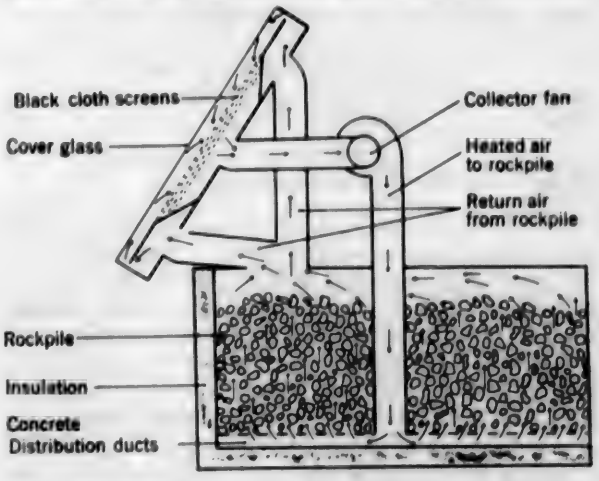

Fig. 2. Schematic view of collector and heat storage unit.

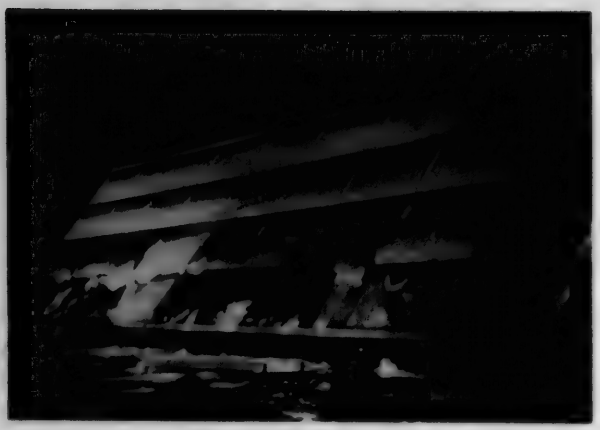

Fig. 3. The locality has only light snowfalls which slide off the face of the collector when the sun strikes it.

four day period being 35 deg. The design calculations indicated that, under the conditions encountered, the collector should barely hold its own against the combined 24-hour house and rockpile loss rates. At the end of these first four exceptionally cold days it was gratifyingly evident that the system had actually performed rather closely as designed. The house was held to proper temperature at all times and the automatically controlled auxiliary heating had never switched on.

Excellent and troublefree performance continued during succeeding days, including another cold week in February, with slowly rising rockpile temperatures. The auxiliary heating unit never operated. It now appears fairly certain that the system does perform substantially as designed, and that no auxiliary heating will ever be required during any normal winter.

In addition to delivering adequate heat, the system has proved very satisfactory in all other respects. Desired house temperature is maintained quite uniformly and the system is very clean, quiet, and draft-free. In general its winter-heating performance is judged to be in every way the equivalent of any conventional high quality forced warm air heating system.

House temperature regime is maintained to suit the occupants, the daytime thermostat usually being set at 72 deg, sometimes a little higher. The clock-timed night thermostat is set at 50 deg, with timing set so that the house is back up to proper temperature before the occupants arise. No particular effort is made either to conserve or to waste heat, except that all rooms of the house are uniformly heated whether occupied or not. The house does not have a fireplace.

Performance Details

The present collector, under typical operating conditions, usually usefully collects about 1,000 Btu per (sq ft) (clear day), or about 315,000 Btu per clear day for the entire collector. This is roughly twice the average 24-hour heat requirement of the house. The excess collected heat goes into the storage rockpile as a reserve against cloudy days or exceptionally cold days, and to make up the heat loss from the storage rockpile. As operated during the initial 1955 heating season, the collector air flow rate was about 4.1 cfm standard air per sq ft of collector. This was a value lower than the design value and has since been increased by setting a group of flow-equalizing dampers within the collector to wider openings. It is expected that the increased flow rate will increase useful heat collection slightly.

The midwinter clear-day useful heat collection of this collector during the initial heating season may be estimated from Fig. 4. This graph gives the daily useful heat collection per square foot of exposed glass; its ordinates should be multiplied by 315 to obtain the clear day useful heat collection of the entire collector. The curves shown on this graph are essentially calculation extrapolations from a single measured point, not individual experimental determinations. The graph is based on the assumption that the January 15th clear-day sunshine incident upon the collector face amounts to 2500 Btu per sq ft, and upon the further assumption that the wind velocity is less than 4 mph. Both of these assumptions are favorable to collector performance but are typical of the locality. The incident sunshine value given is probably about 10% higher than the national average for the particular latitude and date.[3]

Somewhat of a check upon the accuracy of our calculation procedure may be obtained by comparing the calculated and actually observed exit air temperatures from the collector under various conditions. Such a comparison, for noon sun time on the first six clear days following installation of the pyrheliometer, is given by Table 1. The calculated exit air temperatures tabulated are those obtained by calculation from the observed entering air temperatures and outdoor conditions at the time. For one of the days shown in Table 1—February 20th—the comparison of calculated and observed values was carried through an entire day, with the results shown in Fig. 5. The apparent actual useful heat collection for this day was 812 Btu per sq ft, while the calculated value is 956 Btu per sq ft. The two values agree by about 15%. Inspection of Table 1 will suggest that closer agreement would probably have been obtained on most of the other

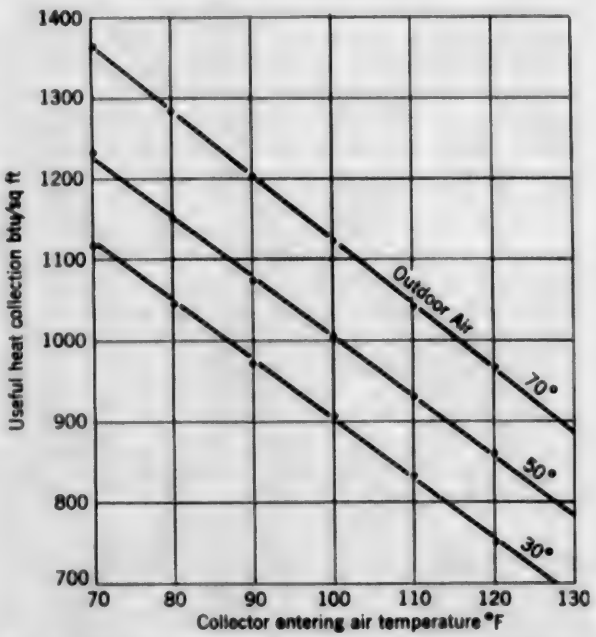

Fig. 4. Average clear-day performance of Desert Grassland collector, January and February, 1955.

TABLE 1—COMPARISON OF OBSERVED AND CALCULATED NOON COLLECTOR OPERATION

Item	Feb. 8	Feb. 10	Feb. 11	Feb. 13	Feb. 19	Feb. 20
Observed Incident Sunshine, Btu per (sq ft) (hr)	360	359	368	348	362	358
Observed Outdoor Air Temperature, F.	62	61	67	73	37	41
Observed Collector Entering Air Temperature, F.	94.5	103	105	108.5	100	93
Observed Collector Exit Air Temperature, F.	133	145	141.5	147	131.5	126.5
Calculated Collector Exit Air Temperature, F.	134.1	141.5	144.5	146.5	135.5	129.5
Apparent Observed Useful Heat Collection, Btu per (sq ft) (hr)	173	185	161	169	141	151
Calculated Useful Heat Collection, Btu per (sq ft) (hr)	177	170	174	166	159	165

days (because the midday values are in closer agreement on most of the other days).

These screen type collectors appear to have first been studied quantitatively by Donovan and Bliss, although there is an early reference in the patent literature to a solar air-heating device using screens.[4] For use at operating temperature levels not more than about 100 deg above outdoor air temperatures they appear to offer promise as a reasonably efficient and economical type of collector. They owe their efficiency primarily to the fairly large total area of the screen filaments and to the ease with which surfaces of this size and shape transfer heat to the circulating air. This results in the screens operating at a temperature only moderately higher than that of the circulating air and consequently minimizes the radiation heat loss from screens to cover glass.

The heat storage capacity of the rockpile is estimated as 27,000 Btu per deg F. A fairly typical mid-winter average rockpile temperature is 120 deg, at which temperature level the rockpile has enough stored heat to supply the house heating load (together with the rockpile loss rate) for about four cold sunless days. In normal winter operation the average rockpile temperature is expected to fluctuate between 90 and 140 deg. The air pressure drop through the rockpile is in accord with data in the literature on such packed towers,[5] and amounts to about 0.10 inch of water for a 3000 cfm air flow rate. (This is a higher flow rate than used in the heating system.) The internal heat transfer coefficient, based on the data of Löf and Hawley,[6] is estimated at around 35 Btu per (hr) (cu ft of rock) (deg F). In other words, if throughout the 1300 cubic feet of rockpile a 1 deg temperature difference exists between circulating air and rock surfaces, then 35 x 1300 x 1 or 45,500 Btu per hr will be transferred. Since the useful collection from the solar heat collector seldom exceeds 60,000 Btu per hr, it can be seen that the internal heat transfer characteristics of the rockpile are excellent. In actual practice this high heat transfer characteristic of the rockpile results in the lowest layer of rocks coming to substantially the temperature of the incoming heated air before the layer of rocks above them is heated. A sizeable vertical temperature gradient may exist in the rockpile, with the highest temperatures at the bottom.

Because of its exposed location the rockpile has a high loss rate, especially so when heating is first commenced and diminishing over a period of weeks as the surrounding ground is warmed. Under typical midwinter conditions this loss rate is believed to amount to around 50,000 Btu per day. This objectionably high figure could have been substantially reduced had it been practicable to install the rockpile directly under the house. Such a drier and more protected location would both diminish the loss and divert much of it into useful house heating.

Design and Sizing

Logical design of solar heat collection systems, both of liquid-heating and air-heating types, requires a good deal more paper work and a good deal less experimental testing than is commonly supposed. Most types of collectors are amenable to reasonably accurate calculation of performance with no testing whatsoever. Usually such calculations can be performed more expeditiously and cheaply than actual testing; in any case they will point the way to a logically organized test program designed to give appropriate information on points which are difficult to calculate. It may be of interest to note that collectors of varying design may differ surprisingly widely in performance; furthermore, details in the design of a given type which at first glance might seem unimportant may markedly influence performance. The collector calculation precedures of Donovan and Bliss generally follow and are greatly indebted to the very excellent work of Hottel and Woertz.[7]

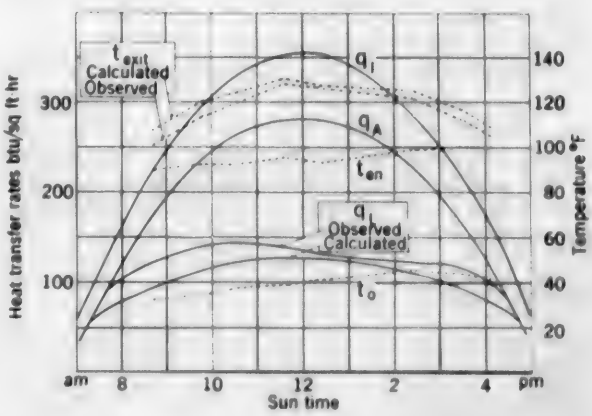

Fig. 5. Collector performance on February 20, 1955.

q_I, incident sunshine on cover glass;
q_A, sunshine absorbed inside collector;
q_L, total loss rate through glass and back;
t_{exit}, temperature of air leaving collector;
t_{en}, temperature of air entering collector;
t_o, temperature of outdoor air.

The sizing of a solar heating system requires careful consideration of the local weather factors, since both performance of the furnace (the solar heat collector) and the loss rate of the house are intimately connected with these factors. The sizing of the collector and the heat storage unit are furthermore not independent of each other, since a somewhat smaller collector can be used if additional heat storage is provided. Finally it is to be noted that a system designed to furnish all needed heat from sunshine alone cannot very well be sized on any weekly or monthly average values of climatic factors. Such a procedure might result in a system capable of supplying enough heat to the house *on the average*—capable, say, of maintaining the house at 90 deg one week and at 55 deg the next week. We judge that some customer complaints might be expected from such a system. The present installation is designed and sized to keep the house warm every day. Very briefly, this sizing was calculated essentially by assuming various reasonable combinations of collector and heat storage unit sizing, and then calculating on a day-by-day basis how each combination would have performed over a six year period according to past weather records. Average monthly values of weather factors for this six-year period and an additional thirteen-year period were then scrutinized to compare with the six-year day-by-day winter analysis.

The end result of all this was a conclusion that, for the particular house and locality under consideration, a collector having a midwinter clear-day useful heat collection of about 300,000 Btu and operating in conjunction with a heat storage unit total capacity of about 800,000 Btu probably could carry quite comfortably the full house-heating load at all times during every winter of the 19 year period except two. These two winters were both much colder and cloudier than normal (a bad combination for a solar heating system) and indicated that excessive oversizing of both collector and heat storage unit would be necessary to handle these apparently exceptional years. The system was hence sized to "fit" the more normal years, with auxiliary heating being provided to handle these apparently abnormal winters which appear to occur in this locality about once every eight or nine years.

A solar space-heating system sized (as this one is) to carry unaided the normal peak midwinter heating load does *not* represent the optimum minimizing of combined operating and amortizing costs. The sum of these two costs is ordinarily lower for a system sized to require some auxiliary heating during peak loads each winter. A procedure for the optimum sizing of such combination systems is available.[8]

Summer Cooling

For summer cooling the same fans, controls, ducts, and rockpile heat storage unit are used, but the collector is disconnected and left idle Slightly undercooled night air is forced through the rockpile each night to cool it, and cooled air is circulated from rockpile to house on demand from the house thermostat.

The operation of the undercooling "night radiator" is illustrated schematically in Fig. 6. It is simply a large horizontal porous screen exposed so that it loses heat by radiant exchange with the night sky, and arranged so that

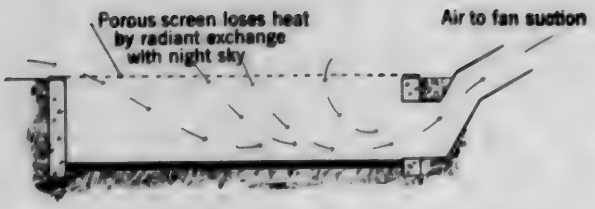

Fig. 6. Schematic view of air-cooling night radiator.

air can be drawn through it. The present one has a cloth screen, an area of about 280 square feet, and is placed in front of the winter-heating collector.

This scheme for air cooling is, of course, feasible only in localities where summer night temperatures are regularly and reasonably low. The undercooling produced by the screen on a clear night is usually about 2 degrees, with an air flow rate of about 10 cfm per square foot of screen. This represents a "refrigerating effect" of about ½ ton for the entire screen. Air-cooling devices of this nature may have limited application; it may be noted that schemes involving the cooling of water by similar "night radiation cooling" means and subsequent storage of the cooled water appear to offer considerable promise in southwestern areas and are presently under study by Donovan and Bliss.

Design calculations indicated that performance of the present summer cooling installation would fall considably short of the performance of a conventional high quality refrigeration system, both in respect to indoor temperature levels and to humidity. No dehumidification means are provided in the present system. Actual performance data for the initial summer season have not as yet been tabulated, but indications are that the present cooling system performs about as expected. It produces a very tolerable indoor comfort level, rather better than that produced by the usual evaporative cooler, but not to be compared with that of a high quality conventional refrigeration system. It is expected, however, that the system will provide much useful information for the design of systems capable of producing a high-quality comfort level the year around.

This installation was not designed as an exact prototype of a similar system which might be commercially competitive with any conventional heating and cooling system. It was built for two reasons. Primarily it is an experimental stepping stone towards design of a complete solar air-conditioning system, capable of high quality performance the year around. Secondly the present installation was built as a demonstration that a properly designed solar heating system will function very nearly as calculated—in this case to furnish all needed winter space-heating from sunshine..

Nevertheless, a discussion of the operating cost and economics of the present system may be of interest. It is not economically sound but, considering the extremely limited amount of work that has been done in this field, it is surprisingly close to being economically sound.

The operating cost of the present system, as might properly be expected, is low. Table 2 presents some pertinent performance and cost figures. It is seen that we estimate the yearly winter space-heating cost at $12 per year. This figure could undoubtedly be reduced, as some of the pressure drops in the present collector are known

TABLE 2—PERFORMANCE AND OPERATING COSTS OF SOLAR HEATING SYSTEM
(initial 1955 operation)

Item	Jan. 21 to Feb. 20	Feb. 21 to Mar. 20	Mar. 21 to Apr. 20	3-Month Total	Full Season (Estimated)
Degree Days	513	288	162	963	1,800
Heat supplied to House by Space-Heating System expressed in Btu x 10^{-8}	4030	2260	1270	7560	14,150
expressed in kwhr	1182	663	372	2217	4140
Electrical Energy Consumption of Space-Heating System					
Fans and Controls kwhr	139	93	84	316	600
Auxiliary Heating kwhr	0	0	0	0	0
Operating Cost (2¢ per kwhr)	$2.78	$1.86	$1.68	$6.32	$12.00

to be exorbitantly high and susceptible of correction, thus reducing the fan power consumption. Summer operating cost of the present system is about the same as that of a conventional evaporative cooler and, as noted previously, performance is approximately similar. Hence the present system may properly be compared to the conventional combination of a high quality winter forced warm air system combined with an evaporative cooler for summer use. The only operating cost saving of the present system occurs in the winter. In the present house this saving would not be large, as the estimated conventional fuel (butane) operating cost is about $80, including furnace fan operation and tank rental. Hence the yearly operating cost saving in the present installation is only about $70.

Actual total labor and materials cost for the present Desert Grassland installation was very nearly $4000. This includes everything except the rather important item of design and engineering, a matter which occupied this writer for about two years. The above cost reflects various experimental and developmental items and, especially, the excessive costs incident to the awkward placement and consequent necessary oversizing of the collector and heat storage unit.

As a reasonable estimate of the entire cost of a copy of this system installed in a moderate-sized house designed for it (and in a southwestern location) we would suggest a figure of between $2000 and $3000. This is, say, about $1500 more than the entire installed cost of a conventional combination of forced warm air furnace and evaporative cooler. The solar space-heating and cooling system might be expected to show a yearly fuel saving on the order of $125 per year. However, the excess amortization cost of the solar heating system over the conventional system would also be on the order of $125 per year. Hence, at the present stage of development of this type of solar space-heating, the system is economically roughly a standoff with conventional systems. When both operating and amortizing costs are considered the costs of both systems are probably somewhere near the same. If further development of solar space-heating systems should result in halving their present initial costs it would appear that such systems would be strongly competitive with conventional heating means.

Hence, we conclude that at its present primitive stage of development a solar space-heating system of this type is roughly off by a cost factor of about 2; that is, it costs about twice what it should in order to be commercially competitive with conventional means in areas favorable for solar space-heating. We believe this to be roughly the the cost situation for other types of solar heat collection and storage systems as well. Although the combination of screen-type collector and loose-rock heat storage unit has certain good points we do not consider it markedly superior to various other well-designed systems.

Solar space-heating systems would thus appear to be rather reasonably close to economic practicality for such an early stage of development. Just how early this stage of development is can be no better emphasized than by pointing out that the backyard contraption described in this article represents one of the three solar-heated houses in operation in the United States today, and that it is the only one to be fully solar-heated.

The preceding paragraphs have analyzed roughly the present cost situation surrounding sunshine-operated systems designed substantially for winter space-heating alone. Whatever their future may be, the future of solar air-conditioning, capable of producing a high-quality comfort level the year around, appears even brighter. In this application the designer of a solar-operated installation has an opportunity to keep most of his equipment working and paying for itself throughout the year. Furthermore, his conventional competition in the air-conditioning fiield consists of devices which have both a high initial and high operating cost. We believe that the field of year-round solar air-conditioning offers great promise in the southwest. It is in this field that the design efforts of Donovan and Bliss are presently chiefly directed, and it was in furtherance of these efforts that the present experimental installation was built.

Most grateful acknowledgment is made to Professor E. H. Warner, head of the Department of Physics, University of Arizona, who throughout this work has contributed more than generously in guidance, advice and encouragement.

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Use of Temperature Controls for House Heating Boilers

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Descriptions of a number of control circuits are presented for applications where the house heating boiler can serve for space heating and, through a tankless heater coil, supply hot water in addition. This is Part 2 of a two-part article, Part 1 having been published in the September issue.

THE tankless heater coil assembly with controls placed on a mounting plate becomes a completely self-contained domestic hot water system, needing only a source of hot water to supply the heat. Locating this assembly in the top of the boiler, Figure 4, where hottest water accumulates, assures the best performance not only for the coil, but for the controls as well. The most effective regulation of maximum boiler water temperature is thus achieved since the high limit control is established in the area of hottest water. The cold water pocket behind the boiler operating control, assures quick response to domestic hot water demand, and so all elements of satisfactory overall temperature control are in that manner established.

From earlier discussion (AIR CONDITIONING, HEATING AND VENTILATING, Sept. 1955, p 77) an average boiler water temperature of 200 deg was found to be necessary for efficient coil operation. Since normal temperature stratification of the water in the boiler during standby periods will show differences of 20 deg or more between top and bottom locations, the temperature at the top of the boiler should be maintained at 210 deg during standby periods and the fixed temperature operating control should be applied to achieve this. The high limit control applied nearby should have a 20 deg higher setting which then allows the use of a wiring circuit as shown in Fig. 5.

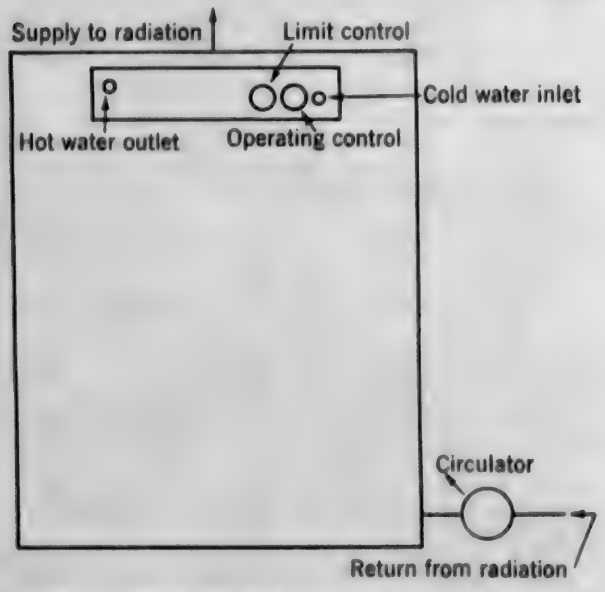

Fig. 4. Tankless heater coil assembly at the top of a boiler.

Control Circuit

With the circuit illustrated in Fig. 5, a demand on the system for house heating from a standby boiler condition

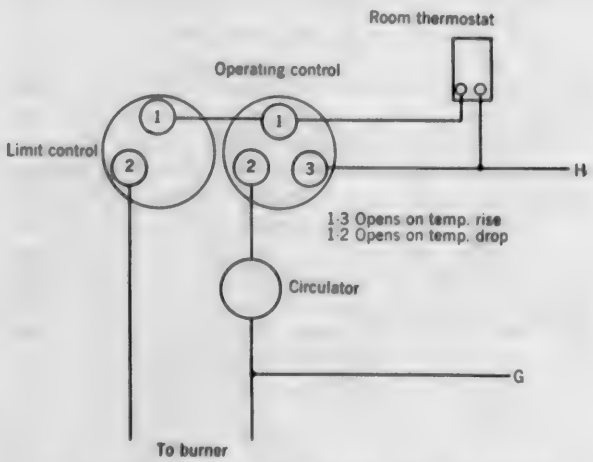

Fig. 5. Circuit using high limit and operating controls.

starts the burner and circulator simultaneously. If the input of the burner is great enough to carry the load, continuous operation of both burner and circulator will follow. If the heating load exceeds the boiler capacity (usually a condition existing after long standby periods), then a drop in boiler water temperature opens circuit 1-2 of the boiler operating control as soon as the drop exceeds its temperature setting. This stops the circulating pump, but the burner continues to operate and when boiler water temperature is restored, the control closes circuit 1-2 and the circulator will start again.

In a well designed heating system continuous operation of the circulator will be attained in one or at most two control cycles, and will carry on until the room thermostat is satisfied. If a demand for domestic hot water should occur during this period, the quick response of the operating control opens the circuit to the circulator in 30 seconds or less and the burner, which is already running, continues to deliver heat for domestic hot water. When the domestic hot water draw is finished, the cold water pocket behind the operating control rapidly assumes the

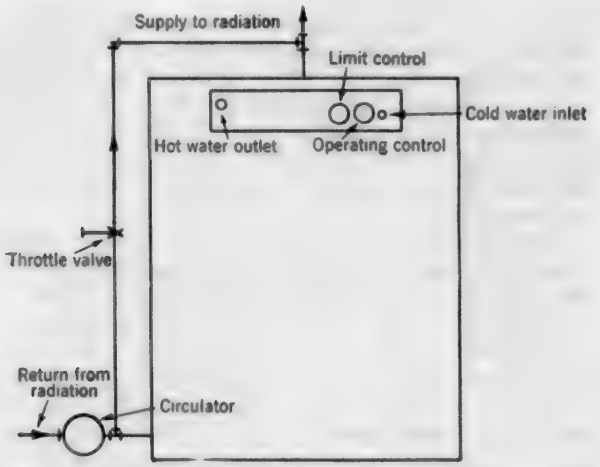

Fig. 6. Bypass around boiler can be used for blending return and supply water.

temperature of the boiler water and circuit 1-2 closes, restoring circulator operation to house heating.

If a demand on the system for house heating produces a load which is less than boiler capacity, boiler water temperature may rise to an indicated temperature of 230 deg on the boiler thermometer before the high limit control stops the burner. In this case the circulator will continue to run as long as the demand persists or until boiler water temperature drops at the operating control. In many cases, this rise in boiler water temperature so delivered to radiation will increase its output and thereby increase the boiler load to a point where a balance is reached before temperature rises to 230 deg. A demand for domestic hot water at any point during a cycle of this type will again cause the operating control to stop the circulator. The response time of the operating control may be a little longer than 30 seconds in this case, because boiler water temperature is somewhat higher than during standby periods. The increased heat available in the boiler under these conditions more than offsets any delay in operating control response. However, since the burner is already operating, the operating control timing is of minor importance.

When a demand for domestic hot water occurs during standby periods, circuit 1-3 of the operating control normally closes within 30 seconds. This period may be shorter or slightly longer than 30 seconds depending on the age of the standby cycle and the temperature of cold water inflow to coil. If the boiler has been on a standby basis for a considerable period the response time of the operating control may be as short as one second. On the other hand if the burner finishes a house heating cycle only a few minutes before the demand for domestic hot water arises, and inlet water temperatures are as high as 60 or 65 deg, then the response time of the operating control may be as long as one minute. If the temperature of water entering the coil is 60 deg, the heat required to raise it to 140 deg at the coil outlet is 20% less than it would be for 40 deg water, whereupon heating requirements are 20% less and the loss of the additional 30 seconds in burner operation is not critical.

Bypass for Blending

Field performance shows that this control system practically guarantees a source of heat at the tankless coil within a temperature range of 200 to 230 deg at all times. It also guarantees the availability of water in this temperature range for the heating system. These are normally considered ideal temperatures for modern baseboard and convector radiation systems. When connected to older style cast iron radiation, these temperatures are generally acceptable. In the few cases where these temperatures are considered higher than necessary, a bypass around the boiler, Fig. 6, can be used to blend a fixed amount of cooler return water with the hot water from the boiler, and thus reduce the temperature to radiation.

Radiant Floor System

When the boiler is connected to floor radiation heating systems requiring lower temperatures, an adjustable mixing valve, Fig. 7, can be arranged to control the temperature to the floor panel. Figure 8 shows an alternate method of piping for floor radiation heating systems that has also been satisfactory. However, this system requires considerable balancing when installed in the field. The flow of water through the boiler must be adjusted by throttle valve to match the heating load.

For illustrative purposes let us assume a boiler having a capacity of 92,000 Btu per hr applied to a radiant system requiring a maximum of 50,000 Btu per hr and maximum water temperature limited to 140 deg in the radiation coils. With a maximum boiler water temperature of 230 deg available at the top of the boiler and 140 deg water entering the bottom of boiler, the temperature rise through the boiler will be 90 deg. With a maximum of 50,000 Btu per hr required for the load, the volume of water circulated through the boiler must be restricted at the throttle valve to

$$\frac{50{,}000}{90 \times 8.33 \times 60} = 1.1$$

gpm. Since measurement of water flow is not practical in the field, measurement by temperature readings can be substituted. Surface type thermometers should be applied both to the radiant panel supply piping and to the outlet connection at the top of the boiler.

The room thermostat is adjusted to maximum setting (thus starting burner and circulator) and the throttle valve is turned to full open. A reading is made of the ther-

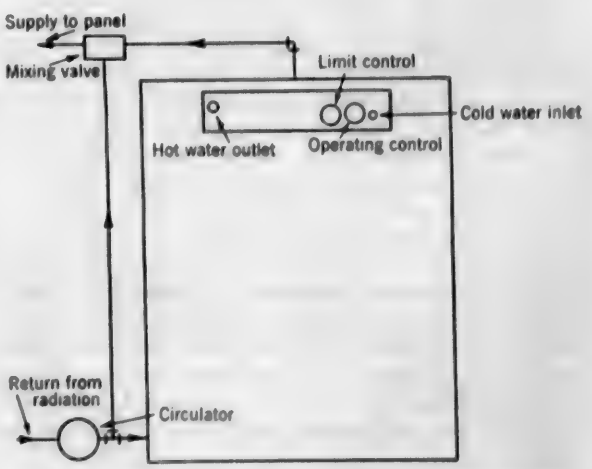

Fig. 7. Boiler connected for radiant heating panels in floor using lower temperatures.

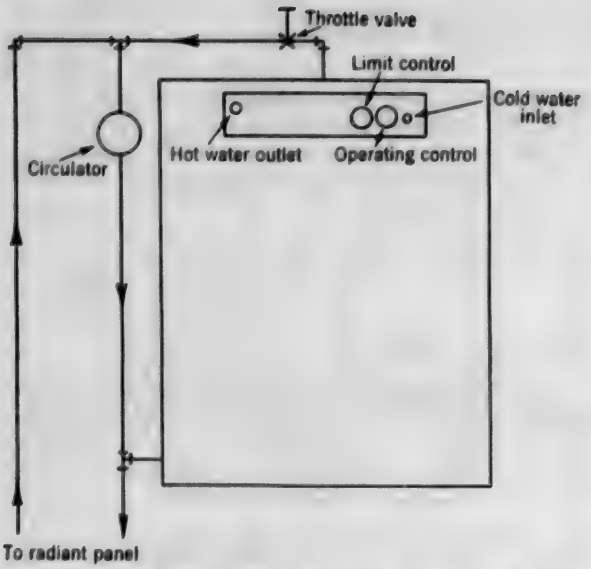

Fig. 8. An alternate method of arranging the piping for floor radiation heating systems.

mometer on the boiler outlet connection when the burner stops by action of the high limit control, and is recorded for future reference. When the high-limit control restarts the burner, the throttling valve is adjusted to maintain a temperature at the boiler outlet connection 5 deg below the temperature previously recorded. As the system heats up, both the panel supply and return temperatures gradually rise. Temperature at the boiler outlet connection also tends to rise, and the throttle valve must be opened accordingly to maintain a 5 deg difference. Constant watch of this temperature during balancing is necessary as is adjustment of this valve. When the thermometer at the radiant panel supply piping reaches 140 deg, lock the throttle valve in this set position. The balancing job is then complete. Continued operation will allow temperature to rise an additional 5 deg at which time the limit control will stop the burner. Circulator will continue to run until thermostat is satisfied. If temperature at limit control drops an amount equal to its differential before thermostat is satisfied, the burner will restart and continue to run until the thermostat is satisfied or the limit control stops burner. In this manner the maximum temperature to the floor coil is limited by action of the limit control. Where radiant panel design requires higher or lower outlet temperature than 145 deg, the same procedure should be followed. The ultimate result of this adjustment procedure is the matching of boiler output to load required as well as limiting maximum water temperature to floor coil.

When a number of boilers are to be applied to a housing project where radiant panel layouts and load conditions are identical from house to house, the problem of balancing can be practically eliminated by test in one house and substituting a fixed orifice instead of throttle valve in the others. Actual experience has also shown that fixed orifice principle can be applied from one housing project to another where load conditions are similar.

Figures 9 and 10 show piping and wiring diagrams for a boiler applied to a radiant panel system using the outdoor reset control system. The use of this system improves comfort conditions within the home by varying the temperature of water to the radiant panel in relation to outdoor temperatures. Usually it is accomplished by varying the temperature of the water in the boiler, but this method can interfere with the performance of the tankless coil to the point where the application becomes impractical.

If piping and wiring are arranged as shown in Figs. 9 and 10, an outdoor reset control can be applied successfully without impairing the supply of domestic hot water. An examination of the piping diagram shows a solenoid valve applied in place of the throttle valve shown in Fig. 5. In smaller homes having heat loss of 75,000 Btu per hr and less, this valve should have a 7/32 in. port opening. Circulator operation is controlled by the room thermostat and if the outdoor reset control is properly selected and adjusted, the circulator will run constantly during the heating season. Temperature of water to the radiant panel is controlled by the outdoor reset control, which opens the solenoid valve and starts the burner when a rise in temperature is required. A demand for domestic hot water will quickly close the solenoid valve through action of the boiler operating control, and thus assure a supply of domestic hot water. Protection of the tankless coil is also provided by the boiler operating control if boiler water temperature should drop below the minimum level required for domestic hot water because of prolonged opening of the solenoid valve.

From the foregoing discussion it is apparent that the same application of boiler operating controls can be used on any type of hot water heating system using fixed temperature thermostats with the same temperature settings and the same wiring hook-up.

Having established the conditions involved in the desired operation, the next stop is a search for the ideal control or combination of controls.

Control Design Requirements

Some of the factors or desirable characteristics required of the controls are: Reliability, quick response, simple and foolproof switching, low differential and reasonably close tolerances, and low cost.

The Spencer snap acting disc type control incorporates all of these characteristics and for this reason was chosen for laboratory and field testing in the original application study.

Many millions of disc type controls are in use in home and industrial epuipment throughout the world and sizeable percentages of these controls have been operating for 15 years or more.

Other millions of disc type circuit breakers are widely used in military and commercial aircraft and automotive equipment, successfully meeting the stringent operating requirements for performance and durability required in such applications.

In the disc type control, the thermal element itself has low mass and is extremely sensitive to temperature change, responding with an abrupt snap action which eliminates the need of magnets over centered springs or other auxiliary mechanism. When associated with heavier masses such as the mounting plate of a tankless heater coil, it responds rapidly and with consistent repeat performance to radiant as well as conducted or convected heat.

Heavy duty contact structures and current carrying members of the switching mechanism can be used to insure simple yet rugged electrical design with contact pressures and current capacity well beyond what is normally required for boiler application. The results of accelerated laboratory testing as well as investigation of actual field experience indicated control life possibilities far and above the specific requirements for the boiler application with a normal expectancy of 15 to 20 years.

To help other boiler engineers develop a successful fixed temperature surface mounted control system of this type, several details which came out of the original application work may be of interest.

It is recommended that the old approach of looking on the tankless domestic water heating system as secondary to the house heating function of the boiler be dropped. Under this earlier concept, the control of boiler temperatures as indicated by boiler thermometer is the criterion of system performance. Actually, the boiler thermometer may be located at a point some distance from the tankless coil installation, and what it indicates may have minor significance in relation to the heating of domestic hot water.

If the engineer will adopt the concept that the supply of domestic hot water is of primary importance and consistent maintenance of temperature at the tankless coil mounting point is the real criterion, he will find that he not only can work out an excellent control system for the domestic hot water function but a very simple and practical control system for the house heating function as well.

Temperature Gradients

Another consideration the application engineer should include in his evaluation of fixed temperature surface mounted controls has to do with temperature gradients.

Regardless of whether a thermostat has a fixed or adjustable setting, it will operate with some temperature gradient in any application. In an adjustable control, compensation can be made for the natural gradient by shifting the setting dial a corresponding amount on the adjusting shaft. The effect of this compensation is to give the appearance of operation with little or no temperature lag.

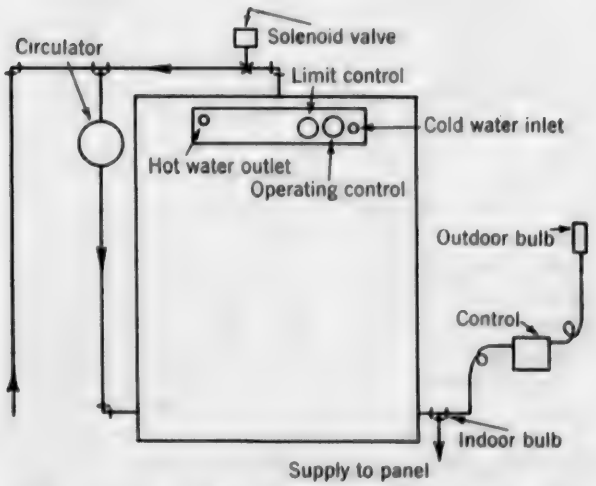

Fig. 9. Piping for boiler applied to radiant heating system using outdoor reset control.

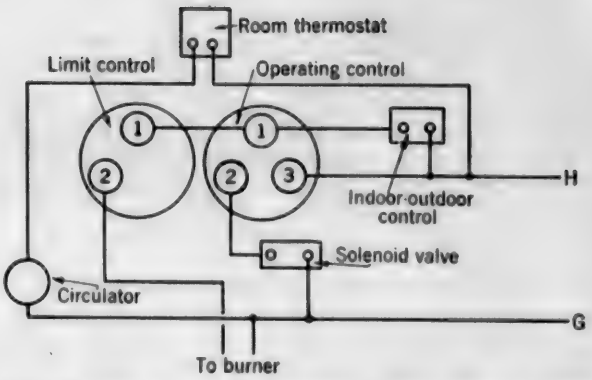

Fig. 10. Wiring for a boiler applied to radiant heating system using outdoor reset control.

In a fixed temperature control, factory calibration is made without compensation for gradient, and the temperature lag thus becomes very evident. Compensation is easily achieved by specifying temperature settings which take the gradient into account.

In the application of temperature controls to a house heating boiler, the amount of gradient, or lag, is dependent on many things: The rate at which temperature change takes place in the boiler under both firing and standby conditions, the mass of the thermal element of the thermostat and the manner in which it is supported, the method of mounting the thermostat and the radiation losses which result.

Design of Cold Water Pocket

So far as working out a temperature control system of the present type is concerned, care should be taken in the design of the cold water pocket. Not only should this be fitted snugly against the inside of the tankless coil mounting plate, but its size must be correlated to the end result desired.

In the first test set-up leading to the present system, the water pocket was made large enough to cover the whole area behind the control thermostat. This gave burner "on" time of around ten seconds after hot water draw was started, which is too fast, because it causes too many unnecessary operations of the burner.

Calculations based on the physical constants of the system indicated ideal burner "on" time of around thirty seconds, and this was achieved by reducing the size of the water pocket, so that it only partially covered the area behind the operating control.

Mounting of Controls

Another factor which proved to be important was the mounting of the two fixed setting controls on the tankless coil plate. A flat surface is preferable to one that is curved. Any weld spatter should be removed from the mounting surface, and a bracket should be provided which will clamp firmly the two controls against the coil plate. A suitable enclosure should be provided for the two controls, not only to enclose the electrical wiring, but also to shield the controls from any drafts of air which would affect their response to temperature change in the coil plate. The enclosure should preferably be insulated.

With these provisions worked out, the controls were found to give remarkably consistent repeat performance with about 10 deg gradient as measured at the coil plate location, although the boiler thermometer often showed readings of considerable variation under the numerous combinations of operating conditions which were investigated.

Service History

Use of the fixed setting temperature controls gives the contractor assurance that the installation will perform immediately in the home just as it operated in the manufacturer's laboratory. The contractor does not have to worry about juggling temperature settings for optimum operation in the home after installation nor does he have to be concerned with the house owner experimenting with the adjustment of the controls feeling that he can save in fuel consumption. Many times, the house owner who experiments with boiler control adjustments finds ultimately to his sorrow that he is not taking maximum advantage of the capabilities of his boiler in doing the most efficient job for a minimum cost. Often he will lock the control system out by crossing operating and high-limit settings without realizing it.

Service experience based on field results with fixed temperature controls have shown over the past three years that service calls created by improper control setting have been practically eliminated. This is attributed to the fact that fixed setting temperature controls enable the manufacturer to maintain supervision of the installation throughout its use. In addition, the installer does not have to guess at the proper initial setting of adjustable controls and then make several comeback calls to get optimum operation and a "satisfied" customer. The man whose installation works correctly from the first day of use, develops a far better reputation for good work than one who must make several service calls before the unit operates as advertised.

At the same time, the service man or contractor does not get paid for the additional comeback calls involved in adjustments and if these can be eliminated, his profits are much greater.

The operation of the installation can also be checked out far more easily and less expensively. The fixed temperature control either operates or it doesn't. This can be proven out by simply running the unit through a prescribed series of operations, and if a control is at fault, it is immediately apparent. In this case a replacement can be made on the spot without inconvenience to the home owner and, of course, at negligible expense to the installer.

Further advantages involved in checking out the system result from the elimination of the repetitive checks which have been made in the manufacturers laboratory. With adjustable type controls, it is desirable to make elaborate checks of the system when installed, and these often involve several long and expensive runs. After each adjustment a verification run must be made. The fixed temperature control system is checked out much more easily with sizeable cost savings in installation.

The fixed temperature control location should be one that is readily accessible to the installer or service man but with limited access to the home owner. Experience has shown that this can be accomplished without sacrificing performance. Thus, if it becomes necessary to replace a control, it can be done on the spot with minimum cost.

Gravity Warm Air Heats Basementless House

An investigation of the performance of a gas-fired wall heater installed in a basementless house was completed by the National Bureau of Standards. Sponsored by the Federal Housing Administration, the study was conducted in the Bureau's test bungalow by O. N. McDorman and P. R. Achenbach of the NBS heating and air conditioning laboratories. The purpose was to determine the temperature distribution produced in the test bungalow by a typical wall heater using either gravity circulation of the air or a small booster fan. Horizontal and vertical temperature gradients were observed as a basis for judging the acceptability of this type of heating system for various climates and for houses of different sizes. The observed heat loss of the test house was also compared with computed values to determine whether the capacity rating of a gravity warm air furnace should be reduced by some fixed percentage when such a furnace was located on the living level of a one-story house.

Results reveal that the heat loss of the structure was not significantly greater than for other similar heating methods where the heating unit is entirely enclosed in the heated space. It was also found that ceiling insulation is desirable to restrict heat loss upward and to promote radiation downward from the warm ceiling surface.

The test bungalow was constructed at the National Bureau of Standards for research in heat transfer phenomena. It has four rooms, a bath, and a small central hallway. Its floor area of 616 sq ft approaches the lower limit of acceptable area for detached single family dwellings. Entire heating systems can be installed in the bungalow to obtain data for estimating the performance of these heating devices in actual dwellings. The bungalow is enclosed within an insulated enclosure so the temperature outside the house can be maintained at any level that might be encountered throughout the United States.

In the present investigation, the heater was located near the center of the house. The distance from the supply grille to the most remote doorway of a connecting room was about 5 ft, and the distance to the center of the most remote room was about 11.5 ft. There was no more than one doorway between the heater and any room to be heated. Thus, the installation was favorable to good temperature distribution from the standpoint of floor area to be served, heater location, room arrangement, and distance from the heater to each of the connecting doorways.

The wall heater, with or without a booster fan, delivers a supply of warm air from one or more grilles with center lines 78 to 80 inches above the floor level. Since practically no duct system is used, the heater can deliver warm air directly into only one, two, or three rooms, depending on the heater location.

AIR CONDITIONING HEATING AND VENTILATING'S

Reference Section

Warm Air Heating

S. KONZO

Professor of Mechanical Engineering, University of Illinois, Urbana, Ill.

Design and operating features of warm-air furnaces and warm-air systems for residences and for larger buildings are developed in the light of many years of research.

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Warm Air Heating

S. KONZO

Professor of Mechanical Engineering, University of Illinois

In a general sense, the term "warm-air heating" applies to any method of heating in which the air is warmed. For example, a steam blast coil, an electrical resistance coil, or a refrigeration condenser coil inserted in an air stream, or the storage chamber of a solar-heated device that eventually heats circulating air may be called warm air heating devices. Hence, although the following discussion is centered upon the conventional, warm-air furnace heating system, many of the comments apply directly to non-conventional types, inasmuch as basic laws of heat transfer are involved.

IF a warm-air furnace is defined as a heat-transfer device in which heat is released on one side of the heat-exchanger surface and heat is absorbed by circulating air on the other side, a large number of devices can be included in this category, some of which are illustrated in schematic form in Fig. 1.

Early Types

(a) *Stove.* The earliest ancestor of the present-day warm-air furnace is the parlor stove, sometimes referred to as the pot-bellied stove. Aside from the cheery aspects of the flame that could be viewed through the isinglass openings, the stove was a utility that was tolerated but not aesthetically admired.

(b) *Pipeless Furnace.* Warmed air rose by gravity action and was delivered into the room above through a large grilled opening in the floor.

(c) *Gravity Hot-Air Furnace (Pre-1918).* These early systems were installed without benefit of engineering knowledge. Air flow was restricted, and the furnaces were aptly described as "hot-air" furnaces, since the air temperatures were in excess of 200 deg F.

(d) *Gravity Warm-Air Furnace (Pre-1930).* The early experimental work at the University of Illinois by Professors A. C. Willard and A. P. Kratz in the period following 1918 showed that, for example, markedly improved results could be obtained by the use of streamlined, amply sized return-air ducts, large warm-air stacks, and registers with ample free area. In these improved systems the actual operating register-air temperature was

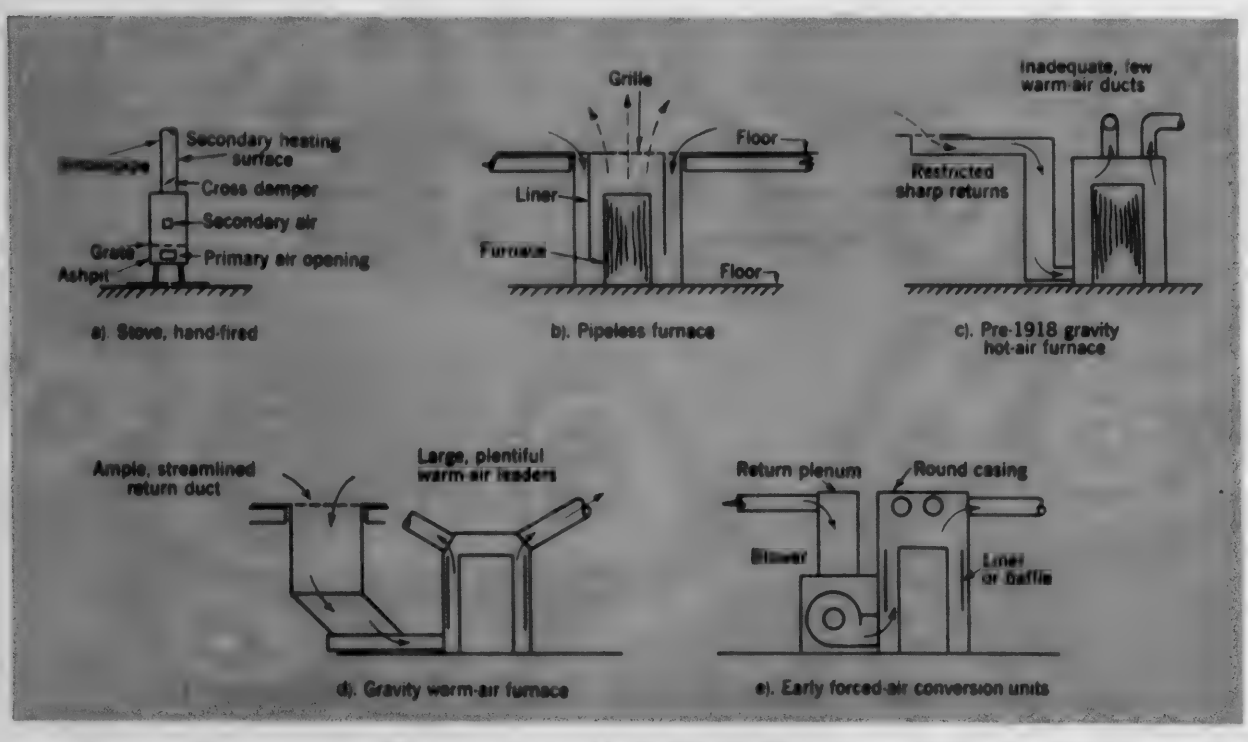


Fig. 1. Developmental stages of forced-air furnace.

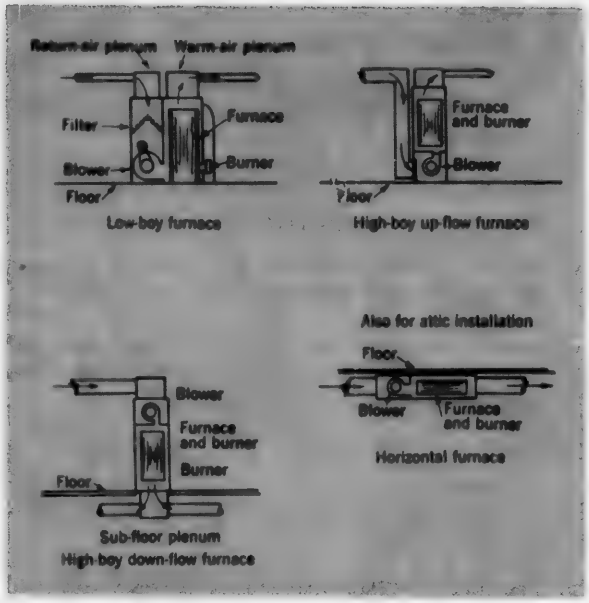


Fig. 2. Current types of forced-air furnaces.

much less than the assumed design value of 175F, even under design weather loads.

(e) *Early Forced-Air Conversion Models (Pre-1940).* Even in the greatly improved gravity warm-air furnace system the surfaces had to be extensive and the furnaces were large in size. The obvious step to increase the heat transfer rate was to use some mechanical means for circulating the air. Propeller fans located in the return-air boot or in the bonnet were found to be lacking in pressure and capacity. When centrifugal fans were placed in a compartment attached to the casing, it was found that furnace casings had to be made smaller to prevent by-passing the heating surface. Later, casings became rectangular and smaller; fans, filters, burners, and controls were integrally built into the casing, and a whole new line of products was introduced. In the trade, the centrifugal fans used for warm-air furnaces are referred to as "blowers," a term which will be used in the remainder of this article.

Modern Types

(f) *Current Forced-Air Furnace Types.* The current types of furnaces, some of which are illustrated in Fig. 2, show a great diversity of shapes and arrangements. Among the principal types used for residences and small buildings the following arrangements are common:

(1) Low-boy arrangement with furnace and blower in separate compartments, and with air discharged upwards. Used for basement installation, but also usable with furnace closets located on the first story.
(2) High-boy arrangement with up-flow of air, in which the blower is located at the bottom of the casing and the heat exchanger is located at the top. Used for either basement installation or for first-story installation.
(3) High-boy arrangement with down-flow of air, in which the blower is located at the top of the casing and the heat exchanger is located below the blower. Used mainly for first-story installation in which warm air is discharged downward.
(4) Horizontal arrangement in which the blower and the heat exchanger are located side by side and the warm air is discharged horizontally. Used for basement or attic installations, or crawl-space installations.

The current types are integrally designed and coordinated units in which the blower and control equipment are selected and arranged for the specific unit. In fact, in the smaller sizes of high-boy units, the furnace package consists of a factory-wired and factory-installed assembly of heat exchanger, blower, blower motor, filter, controls, and humidifier.

Special Types

(g) *Other Current Types of Equipment.* The dividing line between a warm-air furnace and a device which is not a warm-air furnace is difficult to define sharply. The following are included here as special types of warm-air furnaces. See Fig. 3.

(1) *Space Heater.* This reminder of the early parlor stove still persists. Most space heaters are gravity circulating systems, but some are provided with propeller fans to stir the room air. No ducts are attached. Oil-fired and gas-fired space heaters are available, some of them with thermostatic control equipment.
(2) *Floor Furnace.* This device is reminiscent of the early pipeless furnace, but on a much smaller scale and with refinements of automatic firing and controls. The unit is usually attached to the ceiling joists of the basement and is ductless. The circulating air temperature is extremely high with gravity circulating units.
(3) *Wall Furnace.* This device is a space-saving unit that is installed in the wall of a room and is usually a gravity circulation, pipeless unit. Some are tall and some are low enough to be installed just above the baseboard.

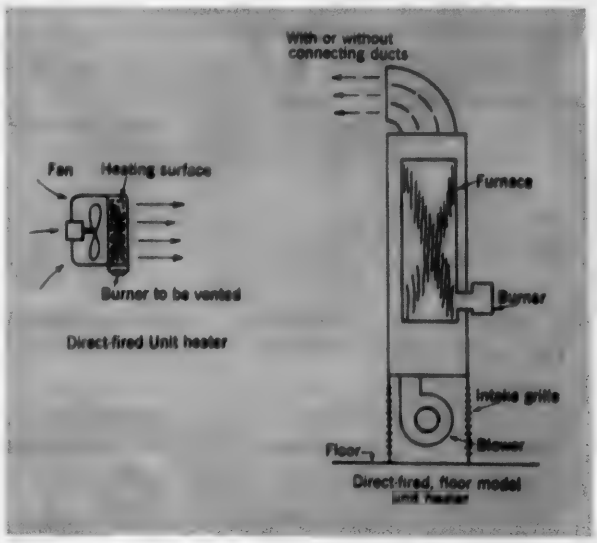


Fig. 3. Allied versions of forced-air furnaces.

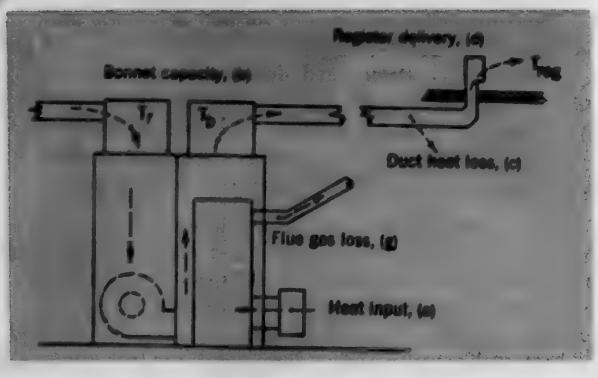


Fig. 4. Terminology related to furnace performance.

(4) *Direct-Fired Unit Heater.* Unit heaters can be direct-fired, either with or without a circulating fan behind the heat exchanger surface. Used mainly for industrial or commercial installations.

(5) *Direct-Fired Floor-Model Unit Heaters.* Extremely large unit heaters are available either with or without duct connections Used for commercial and industrial buildings. Capacities in excess of 1,000,000 Btu per hr are available.

(6) *Industrial Warm-Air Furnaces.* Industrial warm air furnaces, or heavy-duty furnaces, are available with capacities in excess of 1,000,000 Btu per hr. Used for schools, churches, commercial buildings, and industrial buildings.

(7) *Aircraft Air Heaters.* Direct-fired air heaters of small size but high capacity are available for aircraft heating. These are usually gasoline fired heaters.

The styles, models, and types of warm-air furnaces are extremely diverse. Models are available for burning wood, coal, coke, oil fuel, kerosene, natural gas, bottled gas, and manufactured gas. The diversity was the result of demand; the demand of special building types and the demands of both the builder and the public for small, efficient, and economical units.

Furnace Performance Terminology

A few terms appear in catalog descriptions of warm-air furnaces which require definition: (See also Fig. 4).

(a) *Input,* or *Heat Input,* is the rate at which heat is released inside the furnace and is in units of Btu per hr.

For Gas:

$$\begin{pmatrix}\text{Input,}\\ \text{Btu per hr}\end{pmatrix} = \begin{pmatrix}\text{Cubic feet of gas}\\ \text{per hour}\end{pmatrix}\begin{pmatrix}\text{Heating Value,}\\ \text{Btu per cu ft}\end{pmatrix}$$

For Oil:

$$\begin{pmatrix}\text{Input,}\\ \text{Btu per hr}\end{pmatrix} = \begin{pmatrix}\text{Gallons of oil}\\ \text{per hour}\end{pmatrix}\begin{pmatrix}\text{Heating Value,}\\ \text{Btu per gallon}\end{pmatrix}$$

For Coal:

$$\begin{pmatrix}\text{Input,}\\ \text{Btu per hr}\end{pmatrix} = \begin{pmatrix}\text{Pounds of coal}\\ \text{per hour}\end{pmatrix}\begin{pmatrix}\text{Heating Value,}\\ \text{Btu per pound}\end{pmatrix}$$

(b) *Capacity,* or *Bonnet Capacity,* is the heat available in the air at the furnace bonnet, in units of Btu per hr.

$$\text{Capacity} = (\text{cfm})_b\ (60)\ (0.24)\ (d_b)\ (t_b - t_r)$$

in which

$(\text{cfm})_b$ is the air-flow rate in cfm as measured at bonnet temperature,

d_b is the density of air corresponding to bonnet temperature,

t_b is the bonnet-air temperature, deg F, and

t_r is the return-air temperature, deg F.

(c) *Duct Heat Loss* is the heat loss from the warm-air ducts to the space surrounding the ducts, in units of Btu per hr.

(d) *Register Delivery* is the heat available in the air that is delivered from the registers into the space to be heated, and is in units of Btu per hr.

$$\text{Delivery} = (\text{cfm})_{reg}\ (60)\ (0.24)\ (d_{reg})\ (t_{reg} - t_r)$$

in which

$(\text{cfm})_{reg}$ is the air-flow rate as measured at register-air temperature,

d_{reg} is the density of air corresponding to register-air temperature, in units of lb per cu ft, and

t_{reg} is the register-air temperature, F.

(e) *Bonnet Efficiency* is the ratio of the capacity to the input.

(f) *Duct Transmission Efficiency* is the ratio of the register delivery to the capacity.

(g) *Flue Gas Loss* is the heat loss of the flue gases, expressed as a percentage of the heat input, and includes both sensible and latent heat losses. See Fig 5 for a typical flue-gas loss curve.

(h) *Combustion Efficiency* is 100 minus the flue gas loss, expressed as a percentage.

Testing and Rating of Furnaces

A given furnace in combination with a given blower can be operated in a number of different ways and provide almost an indefinitely large number of different capacities and efficiencies. For example, the rate of heat

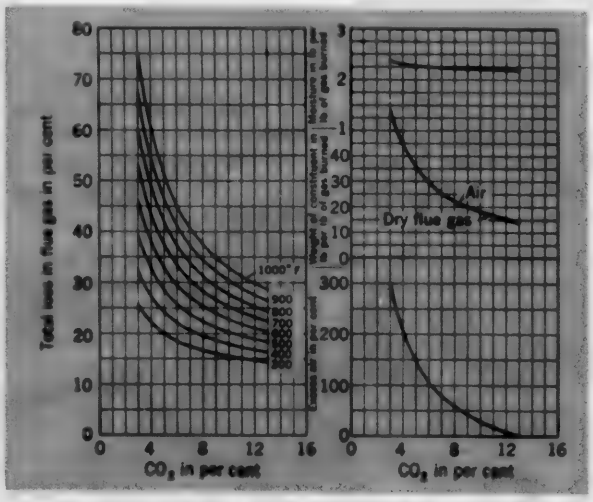

Total loss in flue gas in per cent
Pounds of air per pound of gas burned
Pounds of constituent or Mixture per lb of gas burned
Air
Dry flue gas
1000° F
CO₂ in per cent
CO₂ in per cent

Fig 5. Flue gas losses with natural gas as fuel. (U. of Ill. Eng. Exp. Sta. Circ. 44)

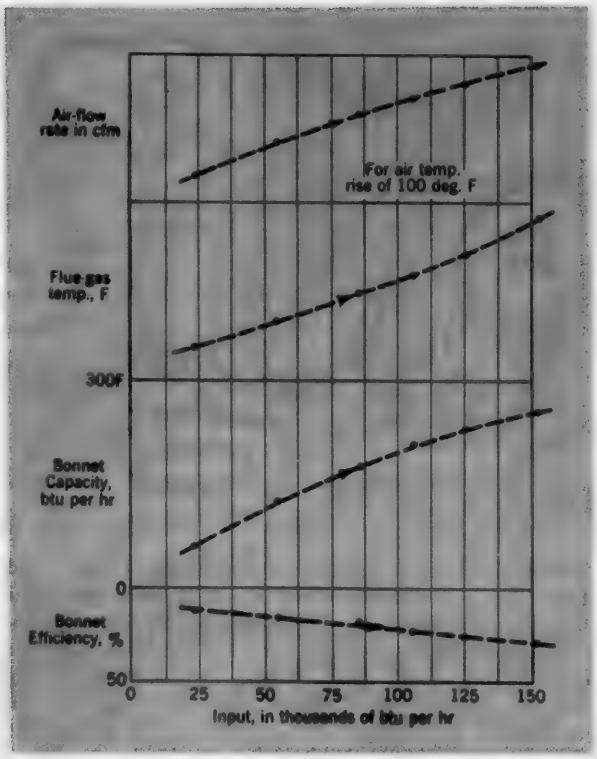


Fig. 6. Typical trends of furnace performance tests.

input to the furnace could be successively increased with a fixed speed of the blower and a set of performance data taken. After this, the whole set of tests could be repeated with another speed of the blower. From the standpoint of a commercial rating, it becomes necessary, therefore, to hold some of the variables at a constant value and to vary only one item. This is shown by a typical performance curve for a furnace, as shown by Fig. 6. For this furnace the rate of fuel input was successively increased after each test, but each time the blower speed was so adjusted that the temperature rise of the circulating air over the furnace was maintained at a constant value of 100 deg. The typical curves in Fig. 6 show some interesting trends, common to all furnace performance tests:

(a) In common with most heat transfer devices, the maximum efficiency occurs at a low value of input. In fact, the efficiency gradually decreases as the input is increased.

(b) The capacity increases with the increase in input, but not in linear relationship. Theoretically, if the input could be made large enough the capacity could be extended indefinitely.

(c) The flue gas temperatures constantly increase with an increase in input since the heat exchanger surface is fixed in amount.

(d) Since the tests were conducted with a constant rise in temperature of the circulating air (100F) the required air-flow rate also increased. Note that it would be possible to conduct tests with a constant flow rate and a constantly increasing air temperature.

From the standpoint of the engineer a complete performance curve of the type shown is much more informative and useful than a single-point rating, but a single-point rating is the only kind of rating that is acceptable to the trade in general. Every manufacturer is interested in a rating of the single-point type. The user is also interested in a single-point rating so that he can select a furnace for a given job and have reasonable assurance that it is adequate but not too large.

Limits

Theoretically, the furnace whose performance curves are shown in Fig. 6 could be rated at any value between say 10,000 Btu per hr up to 160,000 Btu per hr input. As a matter of fact if no limits of any kind were imposed the furnace could have been tested with higher and higher inputs until finally the furnace disintegrated. It becomes obvious that in order for a manufacturer to specify a single-point rating it is necessary for the testing laboratory to impose some arbitrary limits, or boundaries, as to what is acceptable. The single-point rating that is finally chosen would not necessarily be a point of maximum efficiency, since the maximum efficiency was obtained at an abnormally low input and capacity. On the other hand, the single-point rating would not be one for which the equipment was strained to the last notch. The arbitrary limits that happen to be selected by industry are not important for this discussion. What is important is that industry has sensibly and wisely agreed upon certain limits not only for the safeguard of the consumer, but primarily for the protection of the manufacturer who hopes to stay in the business. Industry could mutually agree upon a value of say 75% as the minimum bonnet efficiency that would be acceptable. Or, a flue-gas temperature of say 800F could be considered as the maximum, or the surface temperature of the heat exchanger could be limited to say 900F, or the draft could be limited, or all of these limits could be imposed simultaneously. Whatever capacity that corresponded with the most stringent limit would then be the capacity for rating purposes. In practice, an extremely stringent set of limits have been imposed by the manufacturer acting through such laboratories as the American Gas Association Testing Laboratory. In general, the single-point ratings that are given in catalogs are reasonably attainable values for a well-designed installation. A typical single-point rating for a small gas-fired furnace would show:

Input ... 90,000 Btu per hr
Capacity . 72,000 Btu per hr

All gas-fired forced-air furnaces that bear the approval label of the American Gas Association show a bonnet efficiency of 80 percent, no more and no less.

Selection of Furnace for a Given Installation

The selection of a furnace for a given installation is simple in principle since it consists of selecting a furnace whose capacity is adequate to take care of the heat losses for the building under design weather conditions. In practice, a number of minor points arise that require clarification. For example, if the register delivery is to be made equal to the design heat loss, the manufactur-

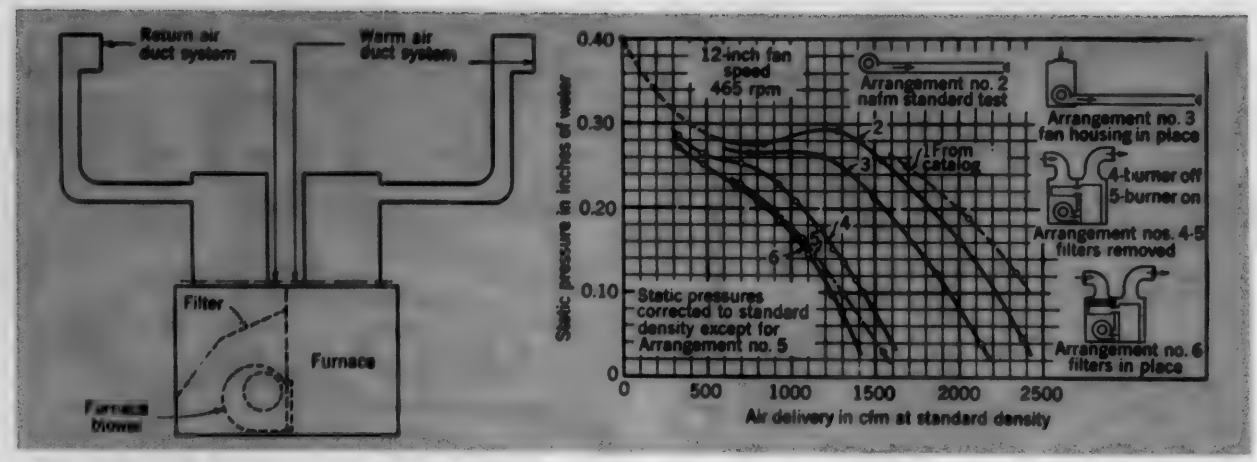


Fig. 7a. (Left) Schematic diagram of a forced-air heating system. Fig. 7b. (Right) Static pressure characteristics of a blower-furnace combination. (U. of Ill. Eng. Exp. Sta. Bul. 300)

er's catalog should either state the delivery or give some means of estimating the duct transmission efficiency. In this connection, the design manuals of the National Warm Air Heating and Air Conditioning Association arbitrarily assume that the register delivery will be 0.85 times the bonnet capacity, or in other words that the duct transmission efficiency will be 85 percent. This assumption may be greatly in error in large installations. Another question that arises in connection with design heat loss is that of determining what portion of the house should be included in the heat loss calculations. For example, should the basement heat loss be considered? If not, what should be done with basement playrooms and hobby rooms?

Rule

For the sake of uniformity and consistency, one set rule is offered for the selection of furnaces, as follows:

> "Calculate the design heat loss for the entire structure, including the basement space, and select a furnace whose bonnet capacity is equal to this design heat loss."

For example, if the design heat loss for the first story rooms is 48,300 Btu per hr and that for the basement is 14,600 Btu per hr, the total heat loss for the entire structure is 62,900 Btu per hr. The furnace for this building should have a capacity equal to or greater than 62,900 Btu per hr. The suggested rule applies to a furnace which is to be located in the space that is to be heated. If, however, the furnace is to be located in a separate building, such as an attached garage or in the attic space, the heat loss from the ducts will be lost and will not be available for heating the house. In this case, it will be necessary to add a correction, to take into account the heat loss from the ducts and the furnace casing, to the design heat loss from the structure.

Blower Characteristics

The blower is an integral part of the smaller furnace-blower combinations used for residential heating and the air-flow characteristics are not for the blower alone, but for the combination. The curves in Fig. 7, for example, show typical performance curves not only for the blower alone but for various arrangements of casing and filter. The performance curve No. 6 is markedly lower than that labelled as No. 2, which is for the blower without any housing. For smaller furnaces, the furnace-blower combination should be capable of providing for an air flow corresponding to a 100 deg temperature rise through the furnace and against a static pressure of 0.20 in. of water, measured external to the furnace-blower combination. In other words, the 0.20 in. of water is for overcoming the frictional losses of the attached duct systems, shown at left in Fig. 7. The internal losses due to frictional effects and expansion losses within the casing and the blower housing have been accounted for by the manufacturer and need not be taken into account by the designer of the duct system.

Blower Sizes

With larger units of the industrial type, the temperature rise through the furnace is usually lower than 100 deg, which corresponds to a larger air-flow rate for a given heat input to the furnace than is characteristic of the small units. For example, temperature rises of the order of 50 to 70 deg are commonly specified for industrial type furnaces. Furthermore, the external static pressure is not limited to 0.20 inches of water and is usually considerably larger.

In order to satisfy the rising trend towards summer cooling, some furnace-blower combinations are provided with more than one size of blower for a given size of furnace. In these arrangements a greater range of air-flow rates is possible without over-speeding a small blower or over-loading the blower motor. Hence, if a given furnace-blower combination is to be used in connection with a refrigeration unit, a larger blower can be made available than is normally used for heating purposes alone. This large blower will permit the use of a cooling coil in the air stream without resorting to an auxiliary fan for overcoming the resistance of the cooling coil.

Duct System Characteristics

The ducts which connect the furnace-blower combination with the registers and return intakes are the only part of the entire system that are not factory planned and fac-

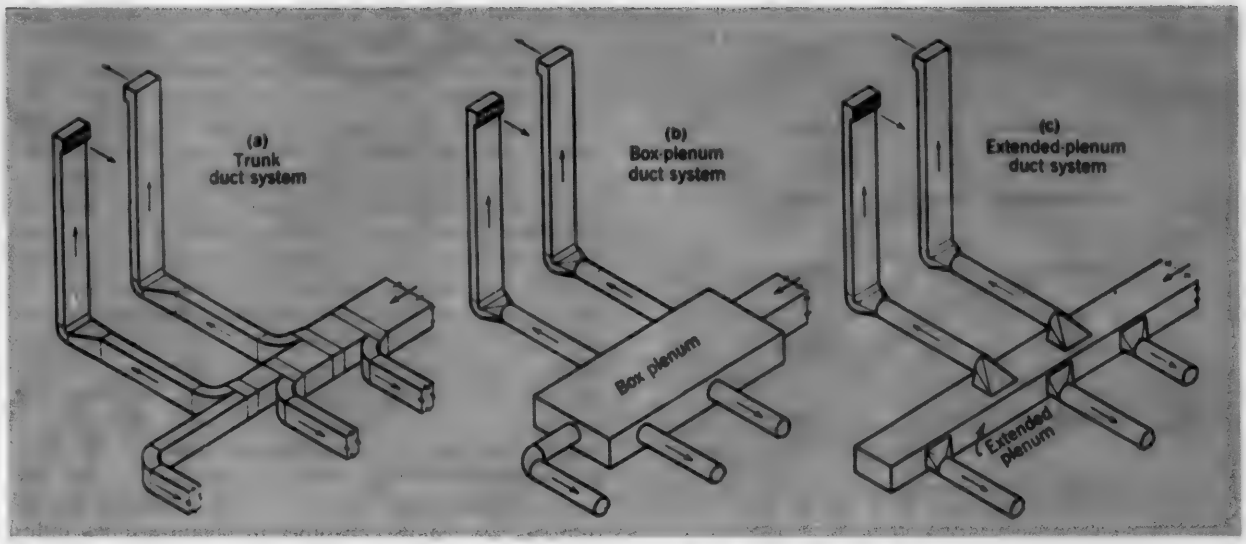


Fig. 8. Three types of air duct systems. (U. of Ill. Eng. Exp. Sta. Bul. 415)

tory assembled. It is true that certain portions of the duct system can be fre-fabricated, but essentially the duct system for each job is a tailor-made affair, no two of which are exactly alike, except perhaps in a housing project.

The duct system plays an important part in the final cost to the owner since a substantial part of the cost and labor is involved in installing the equipment. In Fig. 8 are shown several alternate types of duct systems, although in an actual installation a combination of these different arrangements might be used. In any case the basic arrangements consist of:

(a) *The trunk duct system* with graduated size of trunk duct. This duct system, which is practical for large installations involves costly fittings and many changes in duct section. This system has proven costly to install in small jobs in spite of the use of prefabricated fittings.

(b) *The box-plenum duct system* has advantages in certain installations where it is possible to construct a box plenum. In this arrangement the air is led to a central box, from which a number of individual ducts are tapped off with butt take-off connections. The most common locations of the box plenum are in a central hallway or below the floor of one wing of a large structure.

(c) *The extended-plenum duct system* is a most practical duct system especially for small installations. In this arrangement the trunk duct is not reduced in cross-sectional area, and a number of branch ducts are connected to the extended plenum with simple branch take-off connections.

(d) *The individual duct system* offers the other extreme in duct arrangements. This system is easy to install, but in many cases proves fairly expensive if a large number of individual ducts is to be run to a far end of the building. Furthermore, the heat loss from the ducts can be large and the duct transmission efficiency can be low. The system is easy to balance.

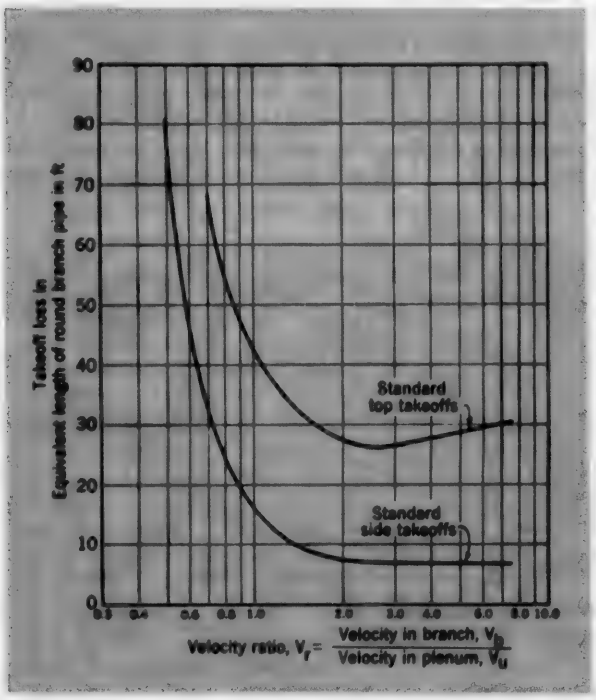


Fig. 9. Loss of extended-plenum fittings, in terms of equivalent lengths of branch duct. (U. of Ill. Eng. Exp. Sta. Bul. 415)

The air velocity near the furnace can be high, over 1000 fpm, but as one proceeds downstream the branch ducts divert air away from the plenum, and the air velocity in the downstream portions of the plenum become smaller. The reduction in velocity head in the plenum is partially offset by an increase in the static pressure. In fact, the static pressures in an extended-plenum duct system tends to be constant throughout the length of the duct. Furthermore, as shown in Fig. 9, the larger entry losses into the branch ducts occur at the upstream branches rather than at the downstream branches. The net result is, therefore, that a larger flow rate is obtained for a given size of duct at downstream branches than at upstream branches, which is contrary to the usual experience with the reduced trunk system. In small jobs

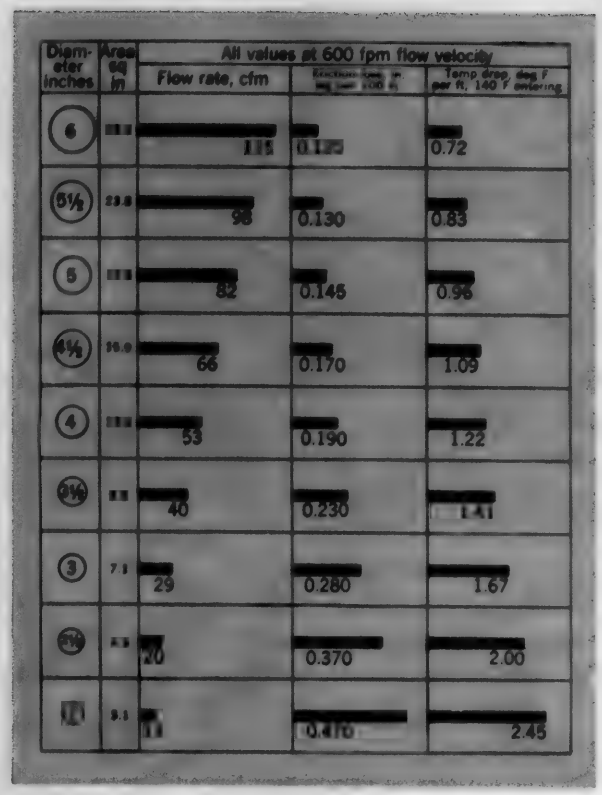


Fig. 10. Characteristics of small air ducts.

where the additional cost of sheet metal used is of little consequence compared to the saving in installation labor and fabrication, the extended-plenum duct system has proven most practical.

Recent Trends

Some interesting trends have taken place during recent years, some of which are conflicting in tendency. In the first place, as a natural outcome of the successful use of small-duct, high-velocity systems for aircraft heating, the idea of using small ducts took hold. In fact, duct sizes ranging from 3 in. in diameter to 6 in. in diameter have been tried. As indicated in Fig. 10, a reduction in duct diameter causes a sharp increase in air friction. Either smaller air-flow rates can be handled through each duct or larger pressure losses can be maintained for the duct system. In fact, as one alternative some thought has been given to the use of static pressures larger than 0.20 in. of water for the duct system. Such an increase can be handled up to a certain point with commercially available blowers. However, when static pressures much in excess of 0.50 in. of water are contemplated, the usual simple low-cost blower is no longer applicable. Hence, increases in static pressure are limited by types of blowers that are commercially available.

The second alternative is to decrease the air-flow rate handled by the ducts and the entire system. This can be done up to a point. It would be possible to increase the temperature rise through the furnace from the current 100 deg to some value such as 150 deg or even 200 deg. This increase in temperature rise would result in a markedly lower air-flow requirement for a given capacity. Unfortunately, the use of higher bonnet-air and register-air temperatures brings additional problems. In the first place, the furnaces that are tested for acceptance by laboratories must undergo a 100 deg temperature rise. For any other temperature rise, special tests will have to be conducted and perhaps some changes made in the test provisions. These changes are not easy to make since they must be accepted by a large segment of industry, including the public utilities. If such changes are considered to be a lowering of the standards, rather than an uplifting, the changes are not easy to make. In the second place, the higher air temperatures in the ducts will result in larger temperature drops of the air in the ducts. Small ducts lose a proportionally larger part of the initially available heat than do larger ducts handling the same velocity of air. By increasing the duct air temperature the heat loss is accentuated. In the third place the introduction of high temperature register air creates problems of air stratification in the room. Special diffusers are required in order to obtain a quick diffusion of the high-temperature air as it enters the room so that the heated air does not simply rise and accumulate at the ceiling.

The current trend towards the use of a single system of ducts for both heating and cooling has also affected the matter of duct sizes. In general, the air-flow requirements for summer for a given space are larger than those for winter. If a duct system is to be adapted for year-around air conditioning the small duct system, which may be most suitable for winter heating, may not be adequate for summer cooling. It would be possible, of course, to provide additional small ducts for use in summer cooling alone. In any case, the trend to smaller and smaller ducts has been stopped pending an evaluation of the year-around air conditioning load.

Warm Air Registers

The flexibility of the forced-air heating system is best illustrated by the wide variety of registers that are commercially available and the extremely diverse methods of installation that are possible. In fact, registers can be installed in the floor, the baseboard, above the baseboard, high in the sidewall, in the ceiling, in the window ledge,

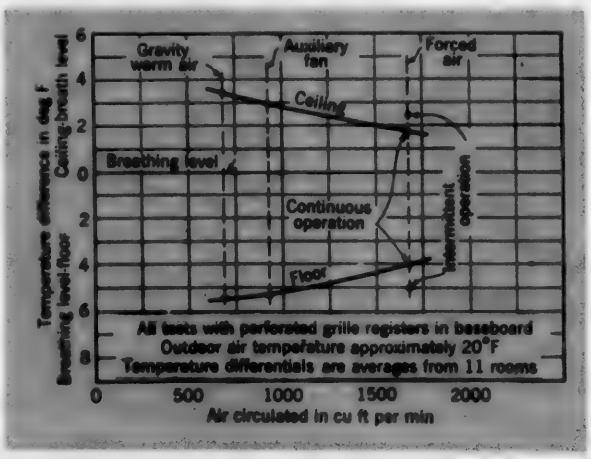


Fig. 11. Temperature differentials with gravity, auxiliary fan, and forced-air systems. (U. of Ill. Eng. Exp. Sta. Bul. 318)

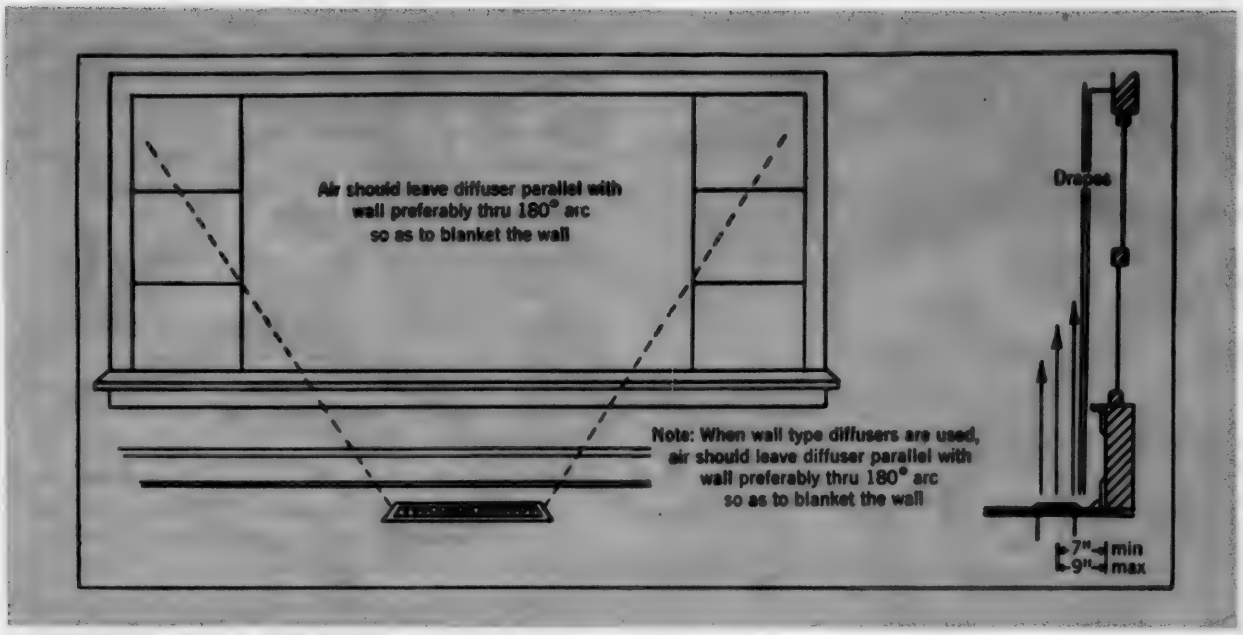

Air should leave diffuser parallel with wall preferably thru 180° arc so as to blanket the wall
Drapes
Note: When wall type diffusers are used, air should leave diffuser parallel with wall preferably thru 180° arc so as to blanket the wall
7" min
9" max

Fig. 12. Location of floor diffuser or wall diffuser below window.

or any other place to which a duct can be run. The more common types of registers consist of:

(a) Rectangular registers of perforated grille or straight vane type that do not provide for air deflection,
(b) Rectangular registers with movable or adjustable vanes that permit deflection, up, down, sideways, or both vertically and horizontally,
(c) Baseboard types that have long narrow openings,
(d) Diffuser types that attempt to mix the register air and the room air rapidly before the air stream has travelled far into the room,
(e) Ceiling registers and diffusers of square, round, rectangular, and oval-shaped designs,
(f) Rectangular slots for use in window ledges, in the floors below windows, or in the ceiling above windows,
(g) A multiplicity of special designs for special purposes, such as railroad cars, airplane cabins, etc.

In many respects the registers are the most important aspect of the forced-air system as far as the occupant is concerned, since it is the visible evidence of the system in the living quarters. When improperly located the registers create drafty conditions and provide poor room temperature conditions. When properly located the registers can do much to improve room air temperature conditions. For example, Fig. 11 shows that for a given location of the registers, the indoor temperatures will be much more uniform with a forced-air system than with either a gravity or auxiliary fan system. The reduction in temperature difference with the use of the forced-air system may be attributed not only to the increase in the quantity of air which was circulated, but also to the decrease in the temperature of the air which was introduced into the rooms.

As will be shown in the next section on duct arrangements, the practical location of a register is governed to some extent by the type of structure in which the system is installed. The use of a baseboard register under a window, for example, may not be practical for a system in which the supply ducts are carried overhead. In general, (a) the register should introduce the air into the room in such a manner that the air does not strike an occupant that is seated and at rest, (b) it should tend to overcome the downdrafts that occur below windows and cold walls, and (c) it should not interfere with furniture placement. Room air velocities in the living zone should preferably not exceed 35 fpm and the moving air stream should not deviate by more than 1.0 deg from the room air temperature. The perimeter warm-air system in which the warm air is introduced through floor registers located along the exposed walls of the structure, as shown in Fig. 12, has proven most successful, even for structures built over concrete slab floors or over unheated crawl spaces.

Return-Air Intakes

The function of the return-air intake or grille is to provide a means for the room air to be returned to the furnace to be reheated and recirculated. In smaller residences the use of one or two return intakes has been found to be as satisfactory as the use of a large number of smaller intakes. As a matter of fact, if the warm-air registers are located so that a small difference in temperature exists from floor to ceiling, the location of the return-intake is not too important. Equally satisfactory results have been obtained with the intakes at the ceiling, at the high sidewall, at the low wall, at the baseboard, and at the floor locations. The return air from small bedrooms escapes from the room through the space below the closed door. The only precaution necessary in the location of a relatively large intake is to avoid a place near seated occupants, not only because of air movement but also because of air noise. A hallway location will usually meet the requirements of a central location and of distance from seated occupants.

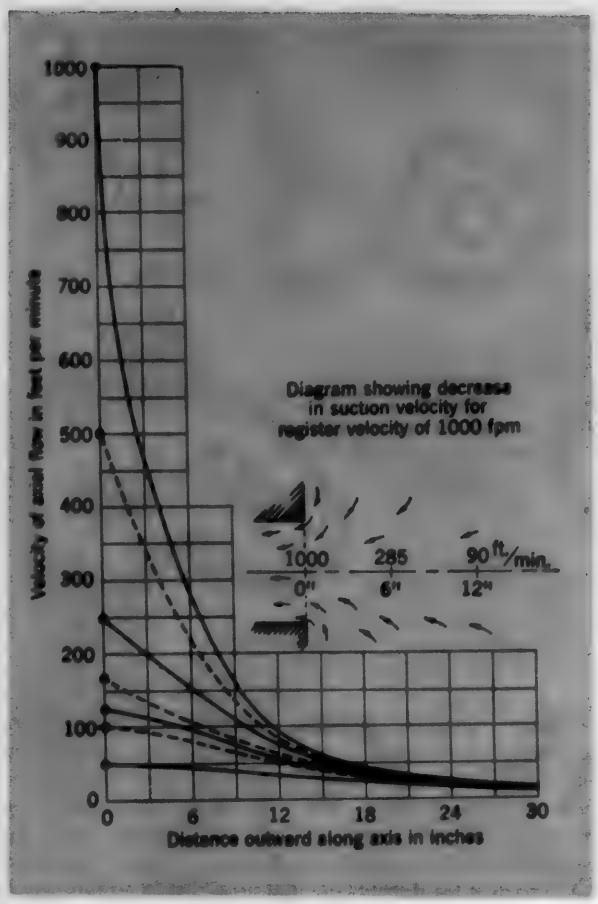


Fig. 13. Velocity of air in front of intake. (Data from Dalla Valle, Control of Industrial Dust, Mech. Eng., Oct. 1933)

Contrary to popular belief, room air cannot be "pulled" towards a return intake. In fact, the pulling action is limited to the immediate vicinity of the intake. Fig. 13, for example, shows how the air velocity diminishes rapidly as the distance from the intake increases. Even with 1000 fpm velocity at the opening, at a distance of 12 inches from the opening the velocity was reduced to 90 fpm, and at a distance of 24 inches from the opening the velocity was essentially room-air velocity or 25 fpm.

An outdoor-air intake can be provided in a forced-air system for introducing outdoor ventilation air into the structure. Such provisions are more common in the milder climate regions of the country. This outdoor air should be conveyed through an individual duct leading from the outdoors directly to the return plenum of the furnace and should be provided with a manually-operated damper. The introduction of large quantities of outdoor air into a structure will result in large fuel bills and a lower relative humidity in the structure. In general, even with moderately large amounts of outdoor air introduced into a structure it is not possible to build up indoor pressures sufficiently to stop window infiltration. It should be realized that fireplace openings, chimney openings, door crackages, and window crackages permit air to flow readily from the structure to the outdoors.

Arrangement of Furnace and Ducts

The discussion up to this point has been with the components of the warm-air system, and not with the integration of the parts into a whole. The arrangement of the furnaces, ducts, registers, and intakes will be dependent upon the type of structure. Since each system is a hand-tailored arrangement for that particular job, no two contractors will agree in all respects on the manner in which the job should be installed. A number of arrangements in common use are:

(a) Basement furnace with ductwork at ceiling of basement.

(b) Utility Room location of furnace with ductwork at the ceiling of the rooms. This arrangement is common with individual apartment units in which each tenant operates his own heating unit and pays for the fuel bill.

(c) House built over a concrete slab floor. Furnace is located in a utility room and all ducts are embedded in the concrete floor to give a perimeter-loop arrangement. See Fig. 14a and 14c.

(d) Same as (c), but with a radial-feeder arrangement of individual ducts in place of the perimeter-loop arrangement. See Fig. 14b.

(e) Slab floor with numerous air passages provided below the floor through which warm air can be circulated. This is a warm-air floor-panel system, one form of which is shown in Fig. 14d. A warm-air ceiling-panel system is also available.

(f) House built over a crawl space. In one arrangement, individual ducts are carried below the floor to the registers in the floor or in the baseboard. In another arrangement, warm air is pumped into crawl space and permitted to enter the rooms above through floor registers, as indicated in Fig. 14f. With a crawl-space plenum system the foundation wall requires special insulation and the ground must be protected against moisture travel from the ground to the crawl space. This arrangement may not be permissible in areas where building codes prohibit ductless systems in combustible areas.

(g) Overhead attic installation of furnace. Furnaces are available for attic space installation. All ducts in the attic space should be heavily insulated since the heat loss from the ducts will not be available for heating the building. See Fig. 14e.

(h) For large buildings the use of multiple furnace units is often possible. Each of several furnaces can be located close to the particular zone to be heated in order to shorten the ductwork. Individual zone temperature control is possible. Multiple furnace systems have been successfully used in the heating of churches, commercial buildings, schools, etc.

The forced-air system is a flexible system and one which has few limitations except that of extreme size. The ducts require no pitching and can be carried upward, downward, or sideways; small air leaks in the ducts are of no consequence; the system needs no purging; the system is extremely responsive to temperature changes outdoors; and all that is required to shut down a plant is to turn off the burner.

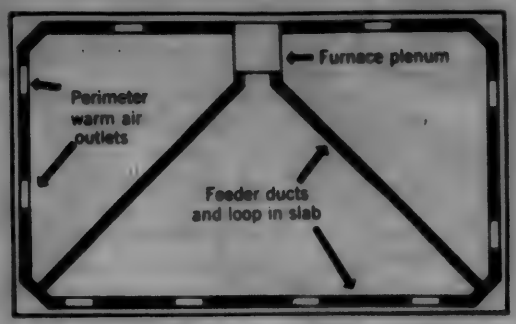


Fig. 14a Perimeter loop system with furnace over loop

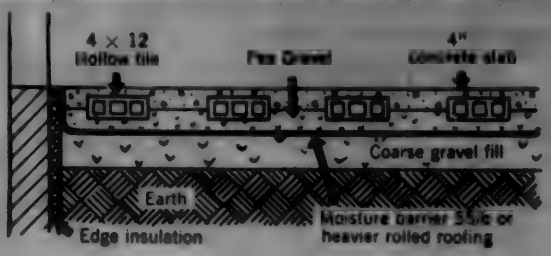


Fig. 14d One form of warm-air floor panel heating

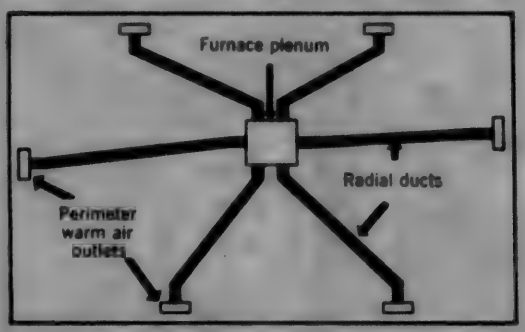


Fig. 14b Perimeter radial system with feeder ducts in concrete slab or crawl space

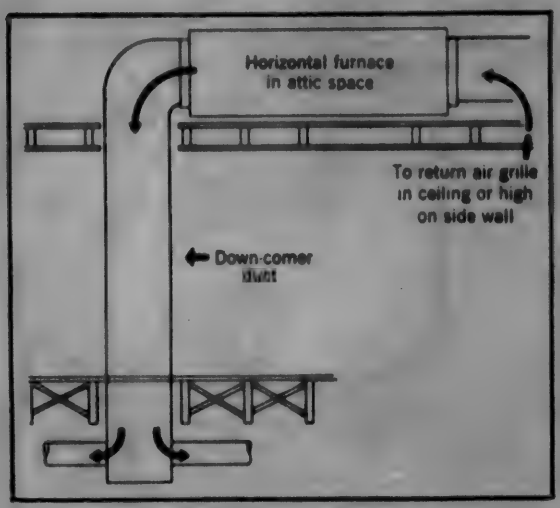


Fig. 14e Attic furnace installation leading to duct system in crawl space

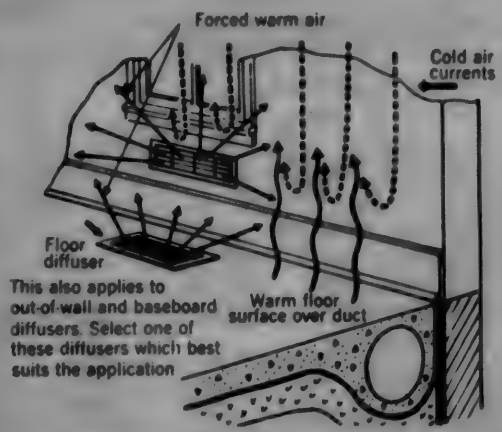

Forced warm air
Cold air currents
Floor diffuser
This also applies to out-of-wall and baseboard diffusers. Select one of these diffusers which best suits the application
Warm floor surface over duct

Fig. 14c Detail of perimeter loop system with floor or baseboard diffuser below window

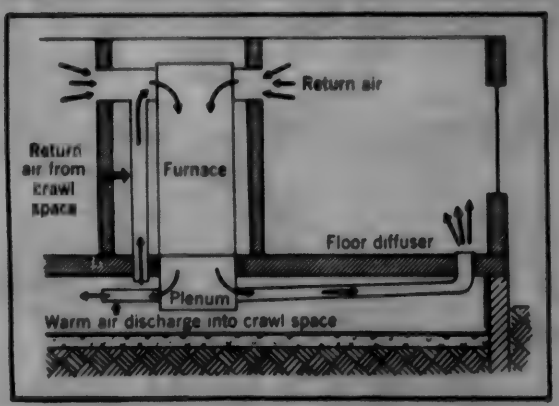


Fig. 14f Down-flow furnace with crawl space duct system and crawl space plenum system shown

Fig. 14. Various forced-air system arrangements.

A few installation precautions are necessary, as is true of any combustion device. The approval tests for furnaces include specifications for space clearances on the sides and top from combustible construction, and such clearances should be provided in the actual installation. If the furnace is to be located in a small furnace room, or closet, the diagrams in Fig. 15a and 15b show the code requirements as far as combustion air supply and closet ventilation is concerned.

Basic Thermostatic Controls

An almost endless number of control arrangements is possible, but the simplest and the most practical is that which is shown in diagram form in Fig. 16. The components consist of:

(a) *Room thermostat* which should be provided with a differential adjustment setting not to exceed about 1.0 deg.

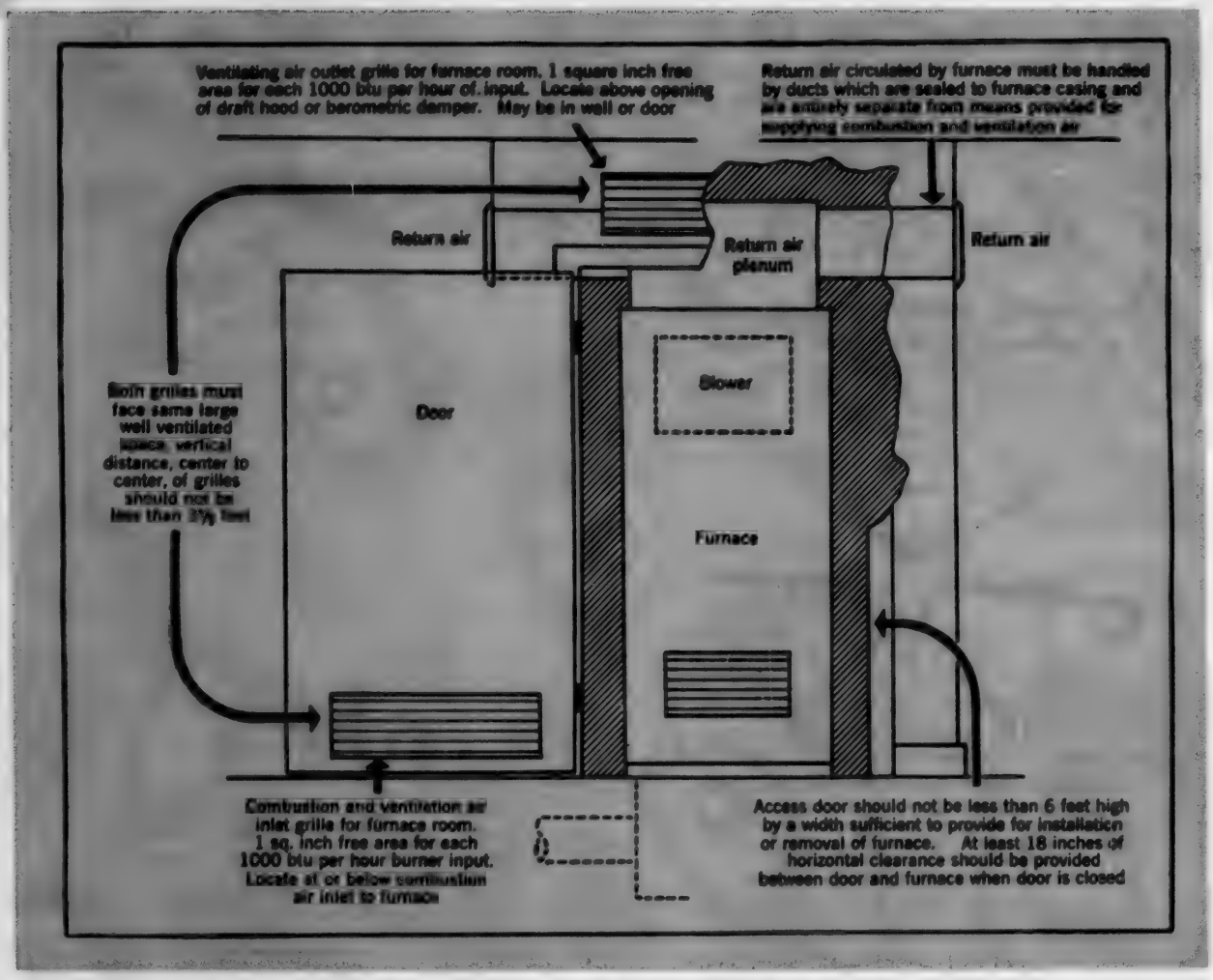

Ventilating air outlet grille for furnace room. 1 square inch free area for each 1000 btu per hour of input. Locate above opening of draft hood or barometric damper. May be in wall or door
Return air circulated by furnace must be handled by ducts which are sealed to furnace casing and are entirely separate from means provided for supplying combustion and ventilation air
Return air
Return air plenum
Return air
Blower
Door
Both grilles must face same large well ventilated space, vertical distance, center to center, of grilles should not be less than 3½ feet
Furnace
Combustion and ventilation air inlet grille for furnace room. 1 sq. inch free area for each 1000 btu per hour burner input. Locate at or below combustion air inlet to furnace
Access door should not be less than 6 feet high by a width sufficient to provide for installation or removal of furnace. At least 18 inches of horizontal clearance should be provided between door and furnace when door is closed

Fig. 15a. Provisions for combustion and ventilation air for furnace closet.

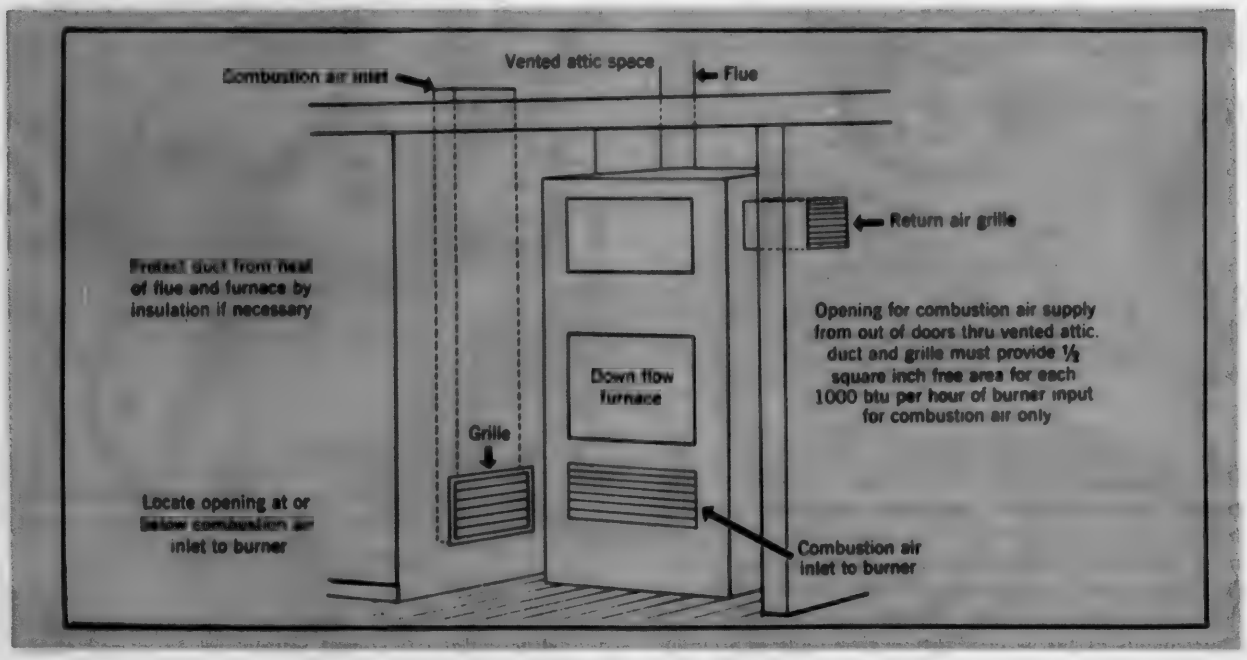

Combustion air inlet
Vented attic space
Flue
Return air grille
Protect duct from heat of flue and furnace by insulation if necessary
Opening for combustion air supply from out of doors thru vented attic, duct and grille must provide ½ square inch free area for each 1000 btu per hour of burner input for combustion air only
Down flow furnace
Grille
Locate opening at or below combustion air inlet to burner
Combustion air inlet to burner

Fig. 15b. Combustion air supply from attic space.

(b) *Limit switch* for shutting off the burner whenever the bonnet-air temperature becomes excessively high. The recommended setting is betwen 175 and 200 deg. In the normal sequence of operation the limit switch is not called upon for action, but is available in case of possible overheating of the furnace.

(c) *Burner motor* or *burner valve* is directly connected to the room thermostat circuit. Obviously, the frequency of operation of the burner is dependent upon the setting and sensitivity of the room thermostat. In a warm-air furnace system, unlike a hot-water or steam system, there is little lag and at the same time no heat storage. In other words, the heat must be generated only as needed and must be distributed as soon as it is generated. For this reason, the sensitivity of the room thermostat must be acute, and the differential settings must be of the order of 0.5 to 1.0 deg. The purpose of the small differential seting is to cause frequent and short operations of the burner. The length of each burner cycle should not, however, be less than about two minutes for a gas burner nor less than about four minutes for an oil burner because shorter operating periods might contribute to large combustion losses due to incomplete burning at the beginning of each burner operation.

(d) *Fan switch* located in the bonnet is a device which turns on the blower when the air temperature in the bonnet is high and turns off the blower when the bonnet-air temperature is low. The recommended setting of the fan switch is about 110 deg for the cut-in point and about 85 deg for the cut-out point. These settings are of great importance in the successful operation of the entire system.

Continuous Air Circulation Principle (CAC)

In many respects the basic principle of a gravity warm-air system of heating is an ideal one and difficult to surpass even with a mechanical system. As shown in Fig. 17, the gravity warm-air system provides a 24-hour circulation of air, the temperature of which is modulated in accordance with the demand. Furthermore, the quantity of air flow is small in mild weather and large in cold weather, so that the air-flow rate is also modulated. In any case, the system is readily adapted to the changing demands of weather, and such changes occur automatically and without artificial stimulus. If it were possible to operate a forced-air system in exactly the same manner and just as simply, the problem of control would be eased.

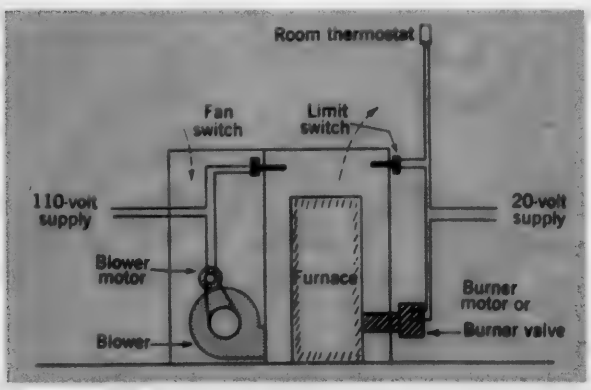


Fig. 16. Basic arrangement of controls.

With a forced-air system, the flow of air is not dependent upon the weather or the heating demands, but is fixed only by the blower speed, the blower size, and the frictional restrictions in the duct system. It is possible with any given duct system to vary the air-flow rate over a considerable range. Furthermore, it is possible to control over a wide range the number of hours that the blower will operate during the day. For example, on a day in which the outdoor air temperature is 30 deg the fan switch can be adjusted so that the blower runs continuously during the 24-hour period, or for 16 hours, or for 8 hours, or for as little as one hour. This wide range of blower operating periods is dependent mainly upon the settings of the fan switch, and to some extent upon the blower speed. Longer operating periods of the blower are desirable since when the blower is operating the control of distribution of heated air is possible; whereas when the blower is not operating, and the system is under the influence of gravity action, no control exists as far as air distribution to the various rooms is concerned.

Continuous Blower Operation

The argument might be raised that if continuous air circulation is ideal, that the system should be operated to give continuous blower operation, as shown in Fig. 18. In this case, the fan switch could be eliminated and the blower operated from a manual switch that is turned on at the start of the heating season and left on all during the season. Or, the fan switch could be left in place and the cut-in point of the fan switch lowered to about 70 deg. The two possible objections to this arrangement are:

(a) That the blower does not need to be operated in extremely mild weather when little heat demand occurs, and that the electrical cost of blower operation could be saved, and

(b) That the temperature of the air issuing from the registers can be as low as room-air temperature and might create objectional drafts in front of the registers.

With high sidewall registers, with floor registers, or with baseboard registers that discharge the air sharply upwards towards the ceiling, this draft possibility does not exist. With such register installations the fan switch cut-in settings can be lowered below 110 deg, and such a lower setting would prove most advantageous from the standpoint of temperature control and uniform distribution of heated air.

Intermittent Blower Operation

For a number of reasons the heating contractors have not appreciated the necessity of obtaining almost continuous blower operation in average heating weather. The influence of gravity warm-air heating practice undoubtedly persists. For example, in gravity heating it was common practice in overcoming the deficiencies of an inadequate plant to raise the bonnet-air temperature, thereby increasing the motive head of circulation, and eventually obtaining a larger air-flow rate.

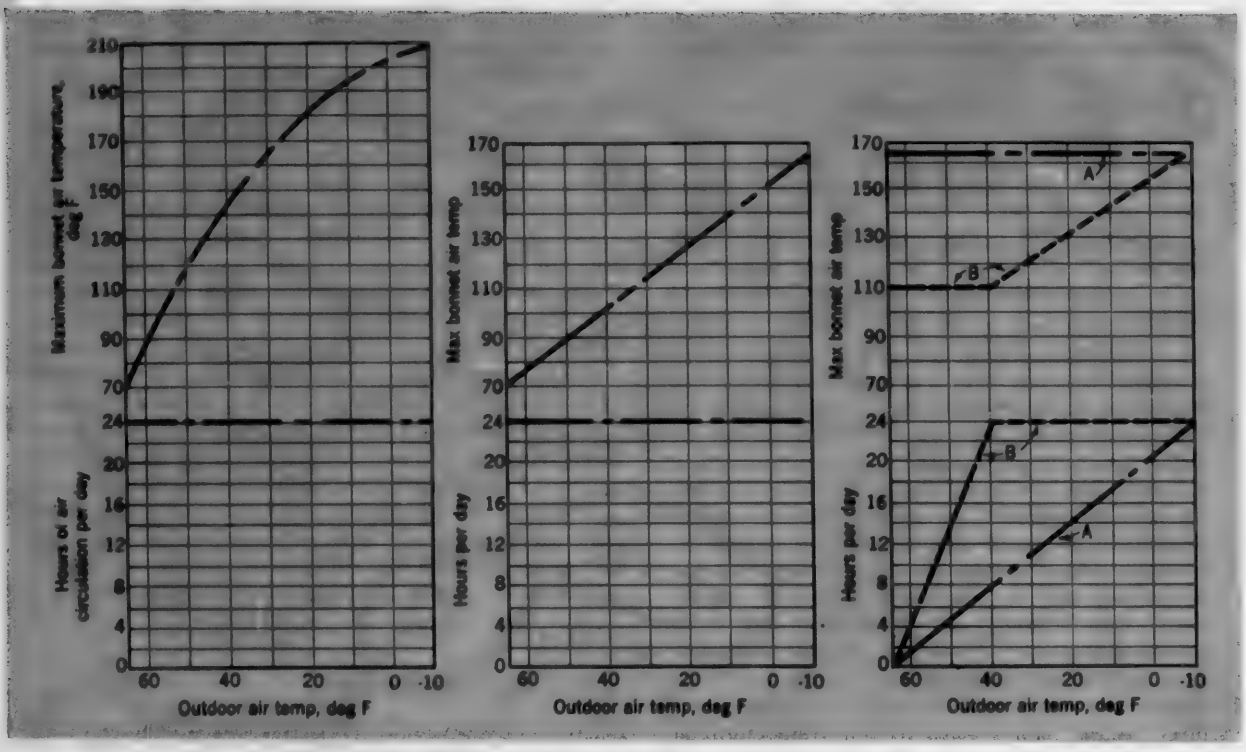


Fig. 17. Air flow and air temperature for gravity warm-air system.

Fig. 18. Air flow and air temperature for continuous blower operation.

Fig. 19. Air flow and air temperature for intermittent blower operation.

In the earlier days of forced-air heating a similar idea persisted. For example, since the design temperature for bonnet air was assumed as 165 deg, the contractor assumed that the fan switch cut-in point should be 165 deg. Under this setting the operation obtained was as shown by the curves labelled (A) in Fig. 19. The bonnet-air temperature would average 165 deg in all weather and the blower would operate intermittently in all weather except during design weather. Frequently, in the case of trouble jobs the contractor raised the cut-in temperature even higher than 165 deg and only aggravated troubles, for the system then operated intermittently under all weather conditions. Essentially, a system so controlled is a "booster" system which is partly gravity and partly mechanical in its operation. Since the ducts were designed for blower operation only it is little wonder that air distribution was poor and the rooms at some distance from the furnace were improperly heated. Many complaints arose that the heating was spasmodic and that when the blower turned on the register air was cold at first. Unfortunately, such poor control operations still exist in many older plants and the potentialities of a good warm-air system have not been realized.

As shown by the curves labelled as (B) in Fig. 19, a lowering of the fan switch cut-in point causes a reduction in the bonnet-air temperature, especially during average weather and a marked increase in blower operating times. As a matter of fact, if the cut-in point can be lowered below 110 deg, the blower begins to operate continuously at much higher outdoor air temperatures. A desirable method of blower operation is considered to be that in which the blower operates continuously as soon as the outdoor temperature drops to about 40 deg.

The matter of proper control settings is so important for the satisfactory operation of a forced-air system that industry has set up rules of procedure for adjusting the heating system. Essentially, these adjustments consist of:

(a) A differential setting of the room thermostat not to exceed 1.0 deg and preferably only 0.5 to 0.75 deg.
(b) Adjustment of the blower speed to give an air temperature rise through the furnace of 100 deg.
(c) Adjustment of the fan switch to give a cut-in point of about 110 deg and a cut-out point of about 85 deg. If a lower setting can be maintained without danger of objectionable drafts in the rooms, the settings should be lower.

Complete details on the adjustment procedure are given in a publication entitled, "Manual 6, Service Manual for Continuous Air Circulation Technicians" published by the National Warm Air Heating and Air Conditioning Association.

Basic Factors for Designing Warm-Air Systems

A large number of different methods exists for use in designing such diverse types of warm-air systems as: (a) small-duct, high-velocity systems, (b) ceiling warm-air panel systems, (c) floor warm-air panel systems, (d) small-duct perimeter systems, (e) large, commercial systems, etc. Regardless of the system of design most of them are based on a few basic concepts, which will be considered in detail. The assumption will be made that the design heat loss of the spaces to be heated has been established.

Bonnet-Air Temperature

The starting point of any design consists in selecting a value for bonnet-air temperature. As can be seen from

TABLE A-1.—DESIGN BONNET TEMPERATURE, REGISTER TEMPERATURE, AND VOLUME OF AIR REQUIRED FOR VARIOUS LENGTHS OF RUN

(For Buildings with Heat Loss Up to 350,000 Btu per Hr)

Upper Figure: Register Temperature
Lower Figure: CFM per 1000 Btu per Hr

National Warm Air Heating and Air Conditioning Association

TEMP. OF BONNET °F	LINEAR DISTANCE FROM BONNET TO REGISTER IN FEET																							
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
110	108 23.1	107 23.6	106 24.2	104 25.4	103 26.0	102 26.6	101 27.3	100 28.0	99 28.8	98 29.6	97 30.5	96 31.5	95 32.3	94 33.3	93 34.6	92 35.9	91 37.3	90 38.6	90 38.6	89 38.9	89 39.9	88 41.3	88 41.3	87 42.7
120	118 19.0	116 19.6	114 20.3	112 21.1	111 21.6	109 22.5	108 23.1	106 24.2	105 24.8	103 26.0	102 26.6	101 27.3	100 28.0	99 28.8	98 29.6	97 30.5	96 31.5	95 32.3	94 33.3	93 34.6	92 35.9	91 37.3	90 38.6	90 38.6
130	128 16.4	126 16.9	123 17.6	121 18.1	119 18.7	117 19.3	115 20.0	113 20.7	111 21.6	110 22.1	108 23.1	107 23.6	105 24.8	104 25.4	103 26.0	102 26.6	101 27.3	99 28.8	98 29.6	97 30.5	96 31.5	95 32.3	94 33.3	93 34.6
140	137 14.6	134 15.1	131 15.7	129 16.2	126 16.9	124 17.3	122 17.9	120 18.4	118 19.0	116 19.6	114 20.3	112 21.1	110 22.1	108 22.5	107 23.6	106 24.2	105 24.8	103 26.0	102 26.6	101 27.3	100 28.0	99 28.8	98 29.6	97 30.5
150	147 12.9	143 13.5	140 14.0	137 14.6	134 15.1	131 15.7	129 16.2	127 16.6	124 17.3	122 17.9	120 18.5	118 18.4	116 19.6	114 20.3	112 21.1	110 22.1	109 22.5	107 23.6	106 24.2	105 24.8	103 26.0	102 26.6	101 27.3	100 28.0
160	156 11.8	152 12.3	149 12.7	145 13.2	142 13.7	139 14.2	136 14.8	133 15.3	130 15.9	128 16.4	126 16.9	123 17.6	121 18.1	119 18.7	117 19.3	115 20.0	113 20.7	112 21.1	110 22.1	108 23.1	107 23.6	106 24.2	104 25.4	103 26.0
170	166 10.8	161 11.3	157 11.7	153 12.2	150 12.6	146 13.1	143 13.5	140 14.0	137 14.6	134 15.1	131 15.7	128 16.4	126 16.9	124 17.3	122 17.9	120 18.4	118 19.0	116 19.6	114 20.3	112 21.1	110 22.1	109 22.5	107 23.6	106 24.2
180	175 10.0	170 10.5	166 10.8	161 11.3	157 11.7	153 12.2	150 12.6	146 13.1	143 13.5	140 14.0	137 14.6	135 14.9	131 15.7	128 16.4	126 16.9	124 17.3	122 17.9	120 18.4	118 19.0	116 19.6	115 20.0	113 20.7	111 21.6	110 22.1
190	184 9.4	179 9.8	174 10.1	169 10.6	165 10.9	160 11.4	156 11.8	153 12.2	149 12.7	145 13.2	142 13.7	139 14.2	136 14.7	133 15.3	130 15.9	128 16.4	126 16.9	124 17.3	121 18.1	119 18.7	117 19.3	115 20.0	113 20.7	112 21.1
200	193 8.9	187 9.2	182 9.6	178 9.9	171 10.4	167 10.7	163 11.1	158 11.6	154 12.1	151 12.4	147 12.9	144 13.4	140 14.0	136 14.4	135 14.9	132 15.7	129 16.2	127 16.6	125 17.2	122 17.9	120 18.4	118 19.0	116 19.6	114 20.3

the following equation, which was presented earlier, the bonnet-air temperature determines the air-flow rate that will be used to maintain a certain capacity.

$$\text{Bonnet Capacity} = (60)\ (0.24)\ (d_b)\ (t_b - t_r)\ (\text{Cfm})$$

For a given capacity, the air-flow rate increases as the bonnet-air temperature is decreased. For example, for a bonnet capacity of 100,000 Btu per hr the air-flow rate will be 1092 cfm for a bonnet-air temperature of 165 deg, but 1004 cfm for a temperature of 115 deg. As noted before, for small residential units the temperature rise ($t_b - t_r$) is arbitrarily determined as 100 deg. That is, for a return-air temperature of 65 deg the bonnet-air temperature is assumed to be 165 deg.

For large furnaces used for industrial and commercial applications a temperature rise of less than 100 deg is usually selected. This corresponds to bonnet-air temperatures less than 165 deg. A suggested method for selecting a bonnet-air temperature is by use of Table A-1 for jobs having a heat loss less than 350,000 Btu per hr, and Table A-2 for jobs having a heat loss in excess of 350,000 Btu per hr. In order to use the tables, both the shortest as well as the longest duct lengths, from the bonnet to the register, should be measured from the building plans.

(a) Using the shortest actual duct length, read downward in the nearest column in Table A until the lower heavy diagonal line is reached, but do not cross the line. Run horizontally to the left to obtain the value of the maximum bonnet temperature in the first column.

For example, for an actual length of duct of 30 ft, the corresponding maximum bonnet-air temperature is 160 deg.

(b) Now, using the longest actual duct length, read downwards in the nearest column in Table A until the upper heavy diagonal line is just crossed. Run horizontally to the left to obtain the value for the minimum bonnet-air temperature in the first column.

For example, for an actual length of duct of 130 ft, the corresponding minimum bonnet-air temperature is 140 deg.

(c) Select as the *design* bonnet temperature any value between the maximum and the minimum, preferably one of the values shown in the first column of Table A. For the example shown, either 160 or 150 deg could be selected.

This method of selecting the bonnet-air temperature merely assures that the final bonnet temperature selected will be between 150 and 110 deg, corresponding to temperature rises through the furnace of 85 and 45 deg. Regardless of whether the design bonnet temperature was arbitrarily selected or by the preceding method it must be used thereafter for determining the air-flow rates.

Temperature Drop of Air in Ducts

The individual boxes in Table A show two values; the upper value is the estimated register-air temperature and the lower value is the cfm air-flow rate for each 1000 Btu per hr heat loss. For example, the box corresponding to

TABLE A-2.—DESIGN BONNET TEMPERATURE, REGISTER TEMPERATURE, AND VOLUME OF AIR REQUIRED FOR VARIOUS LENGTHS OF RUN

(For Buildings with Heat Loss Greater than 350,000 Btu per Hr)

Upper Figure: Register Temperature
Lower Figure: CFM per 1000 Btu per Hr

National Warm Air Heating and Air Conditioning Association

TEMP. OF BONNET °F	LINEAR DISTANCE FROM BONNET TO REGISTER, IN FEET																						
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
140	138 14.4	136 14.8	134 15.1	132 15.7	130 15.9	128 16.4	127 16.6	126 16.9	125 17.2	124 17.3	123 17.6	121 18.1	120 18.4	119 18.7	118 19.0	117 19.3	116 19.6	115 20.0	114 20.3	113 20.7	112 21.1	111 21.6	110 22.1	109 22.5
150	148 12.8	146 13.1	143 13.5	141 13.9	139 14.2	137 14.6	135 14.9	133 15.3	131 15.7	129 16.2	128 16.4	127 16.6	126 16.9	124 17.3	123 17.6	122 17.9	120 18.4	119 18.7	118 19.0	117 19.3	116 19.6	115 20.0	114 20.3	113 20.7
160	158 11.6	155 12.0	152 12.3	150 12.6	147 12.9	145 13.2	143 13.5	140 14.0	138 14.4	136 14.8	134 15.1	132 15.7	130 15.9	128 16.4	127 16.6	126 16.9	125 17.2	124 17.3	123 17.6	121 18.1	120 18.4	119 18.7	118 19.0	117 19.3
170	167 10.7	164 11.0	161 11.3	158 11.6	155 12.0	152 12.3	150 12.6	147 12.9	145 13.2	143 13.5	140 14.0	138 14.4	136 14.8	134 15.1	132 15.7	130 15.9	128 16.4	127 16.6	126 16.9	125 17.2	124 17.3	123 17.6	121 18.1	120 18.4
180	177 9.9	173 10.2	170 10.5	167 10.7	164 11.0	161 11.3	158 11.6	155 12.0	152 12.3	150 12.6	147 12.9	145 13.2	143 13.5	140 14.0	138 14.4	136 14.8	134 15.1	132 15.7	130 15.9	128 16.4	127 16.6	126 16.9	125 17.2	124 17.3
190	186 9.3	182 9.6	178 9.8	175 10.0	172 10.3	168 10.7	165 10.9	162 11.2	159 11.5	156 11.8	153 12.2	151 12.4	148 12.8	146 13.1	143 13.5	141 13.9	139 14.2	137 14.6	135 14.9	133 15.3	131 15.7	129 16.2	128 16.4	127 16.6
200	196 8.8	191 9.0	187 9.2	183 9.5	179 9.8	176 9.9	172 10.3	169 10.6	166 10.8	163 11.1	160 11.4	157 11.7	154 12.1	151 12.4	149 12.7	147 12.9	144 13.4	142 13.7	140 14.0	138 14.4	135 14.9	133 15.3	131 15.7	130 15.9

a bonnet-air temperature of 110 deg and a duct length of 10 ft gives 108 deg as the register-air temperature and 23.1 cfm for each 1000 Btu per hr room heat loss. It is apparent that the values in Table A take into account the temperature drop of the air as it flows down the duct. The tabular values also indicate that the temperature drop is greater when the bonnet-air temperature is higher. For example, for a bonnet-air temperature of 110 deg the temperature drop is 2 deg in 10 ft of duct, whereas for a bonnet-air temperature of 200 deg, the temperature drop is 7 deg in 10 ft of duct. A further examination of the Table shows that the temperature drop is relatively large for distances close to the bonnet and is relatively small for distances away from the bonnet. In other words, the temperature drop of air in the ducts is not a constant value.

The temperature drop data used in setting up Table A were obtained from the basic data given in Bulletin 351 (Univ. of Ill. Eng. Exp. Sta.). The basic curves, shown in Fig. 20 for various duct velocities, apply to uninsulated, galvanized-iron ducts located in an environment of 70 deg. For the purpose of deriving the values in Table A it was necessary to assume average values for duct velocity (800 fpm) and duct size (10 in. diameter), since neither were known at this point in the design procedure. Theoretically, a correction in temperature drop could be made later for actual duct velocities and actual duct diameters used, but in actual practice the correction is not warranted. The register-air temperatures, shown in the upper part of each box in Table A, would be slightly high for velocities less than 800 fpm and for ducts smaller than 10 in. in diameter, and hence would give lower values of cfm requirements for 1000 Btu per hr loss than if corrected values were used. However, calculations made for a 6-inch duct carrying air at 400 fpm velocity indicated that the maximum discrepancy was only of the order of 6%. Conversely, the cfm requirements shown in Table A would be on the safe side for ducts larger than 10 inches in diameter and for air velocities greater than 800 fpm. Hence, in spite of the fact that the values in Table A were based upon a specific diameter and velocity, the results obtained from their use should be well within the accuracy required for ordinary calculations.

Register-Air Temperature and Room Air Requirements

The register-air temperature is obtained by subtracting the temperature drop from the bonnet-air temperature. This register-air temperature in turn establishes the air-flow rate necessary at the register face to offset the heat loss from the space to be heated. The equation for air-flow rate at the register is:

$$\text{Cfm at register} = \frac{\text{Design heat loss, Btu per hr}}{(60)\ (0.24)\ (d_{reg})\ (t_{reg} - t_r)}$$

A study of the data in Table A shows that a larger air-flow rate is needed for those rooms at some distance from the bonnet. For example, for a bonnet-air temperature of 150 deg, a register that is 10 ft from the bonnet requires 12.9 cfm for each 1000 Btu per hr room heat loss, whereas a register which is 100 ft from the bonnet requires 17.9 cfm for each 1000 Btu per hr heat loss. This is an increase of 39% to take into account the heat loss from the duct.

With the exception of duct systems installed in small homes, where the branch ducts are about the same length, considerable errors will be introduced if a constant register-air temperature is assumed to exist at all registers. Such errors in air-flow requirements will necessitate drastic adjustments in balancing after the duct system is installed. After the air-flow rates have been determined

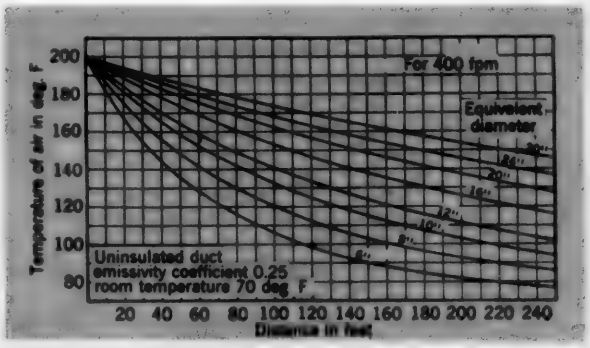


Fig. 20a. Temperature drop for air velocity of 400 fpm.

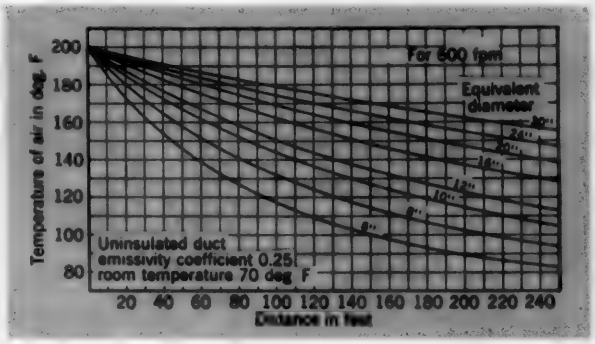


Fig. 20b. Temperature drop for air velocity of 600 fpm.

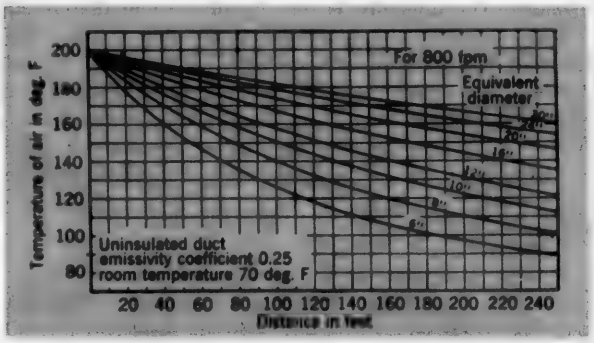


Fig. 20c. Temperature drop for air velocity of 800 fpm.

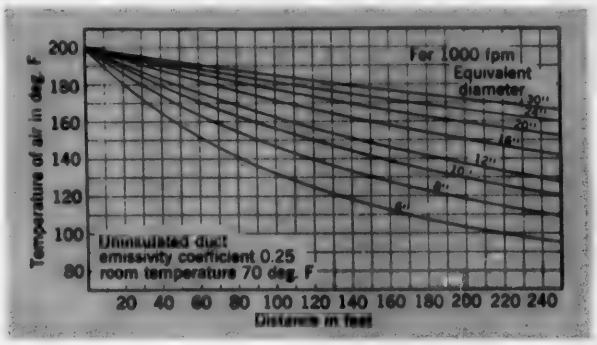


Fig. 20d. Temperature drop for air velocity of 1000 fpm. (U. of Ill. Eng. Exp. Sta. Bul. 351)

for each register, the total cfm may be considered the same as that handled by the blower even though a slight density correction is theoretically necessary.

Available Static Pressure at Bonnet

In the case of small furnace systems the available static pressure external to the furnace-blower combination is considered to be 0.20 inch w.g. This pressure of 0.20 inch w.g. is available for the losses in both the warm-air and return-air sides of the system. For large furnaces, such as are used for commercial and industrial buildings, no fixed value of external static pressure is used. In fact, a wide range of values is permissible, and a choice of several blower sizes is possible. Normally, however, the static pressures do not exceed about 1.0 inch of water. Suggested bonnet pressures are given in Table B.

Before a blower can be selected for the given job, it is necessary to estimate two other items and add them to the bonnet pressure:

TABLE B.—SUGGESTED BONNET PRESSURES

Total CFM Through Any One Duct	Suggested Bonnet Pressure, Inches Water Gage
800 to 1,000	0.10
1,000 to 1,200	0.10
1,200 to 1,800	0.10
1,800 to 2,400	0.13
2,400 to 3,500	0.14
3,500 to 5,000	0.15
5,000 to 7,500	0.25
7,500 to 10,000	0.375
10,000 to 12,000	0.50
12,000 to 14,000	0.75

(a) the pressure loss for the return duct system, and
(b) the pressure loss for internal losses through the furnace casing and the blower housing. This item should be available from the furnace manufacturer. In any case, the manufacturer should be able to recommend the blower size and speed to handle loss items for the bonnet and the return system.

Before the static pressure at the bonnet is finally fixed, some consideration should be given to the pressure required for the throw of air from registers. This becomes of great importance where the throw is greater than about 30 feet, or where the air must be rapidly dispersed outwards.

Throw of Air from Registers

The data of Tuve and Priester (ASHVE Tr. 1944, p. 153) are the most comprehensive of the references investigated. The basic equation proposed by Tuve and Priester was of the form:

$$V_r = \frac{K\ Q}{X\ \sqrt{A_o}} \qquad (1)$$

in which,

V_r is the residual maximum velocity, fpm,
K is a constant to be determined by test,
Q is the volume of air discharged, cfm,
X is the throw of air, ft,
A_o is the effective area of outlet, sq ft.

Furthermore,

$$A_o = A_e/C \qquad (2)$$

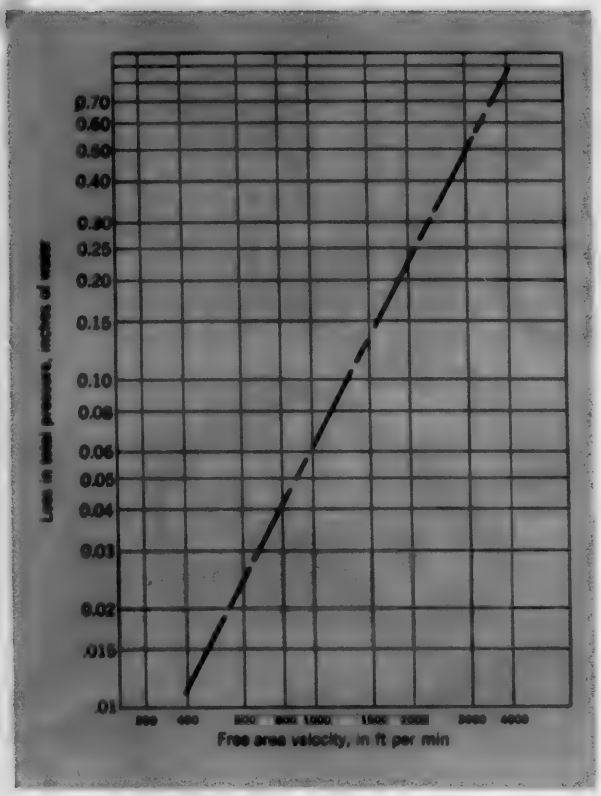


Fig. 21. Total pressure loss of register as affected by free area velocity. (Based on tests with 22 commercial type registers.)

and

$$V_c = Q/A_c, \text{ or } A_c = Q/V_c \qquad (3)$$

in which

A_c is the core area of register, sq ft,
C is the coefficient of discharge,
V_c is the core velocity, fpm.

By rearranging Equations (1), (2), and (3), the following form was derived:

$$V_c = \frac{X^2}{Q}\left(\frac{C\,V_r^2}{K^2}\right) \qquad (4)$$

Numerical values for $V_r = 50$ fpm, $K = 2.5$, and $C = 0.61$ were inserted in Equation (4) and the relationship was simplified to the form:

$$V_c = \frac{X^2\,(244)}{Q} \qquad (5)$$

By substituting numerical values for X and Q in Equation (5), values of V_c were obtained, and these in turn were substituted in Equation (3) to give the required core areas, A_c.

Free Areas

In order to obtain free areas, which are commonly given in manufacturer's catalogs, the assumption was made following consultation with the register manufacturers, that the ratio of free area to core area was 0.78. Hence, by the use of a modified version of the Tuve-Priester equation, relationships between throw, volume, and free areas of registers could be obtained.

A residual velocity of 50 fpm at the wall opposite a register might be considered too large, and an average stream velocity of the order of 15 fpm to 20 fpm might be considered as more reasonable. It is possible to modify equation (5) by inserting a value for the residual velocity of the order of 20 fpm. However, it is questionable whether such an extrapolation to velocities which are practically unmeasurable can be justified. The suggestion has been made that the length of the throw should be considered to be some proportion of the width of the room, say ¾ of the width of the room, and that the values obtained from equation (5) be applied to this shortened distance. The difficulty is that ¾ of a room that is 20 ft wide is only 15 ft, leaving 5 ft distance between the far wall and the end of the throw; whereas ¾ of the distance of a room that is 60 ft wide is 45 ft, leaving a 15 ft distance from the far wall and the end of the throw. In the small room the air may have sufficient momentum to carry on to the far wall, whereas in the larger room

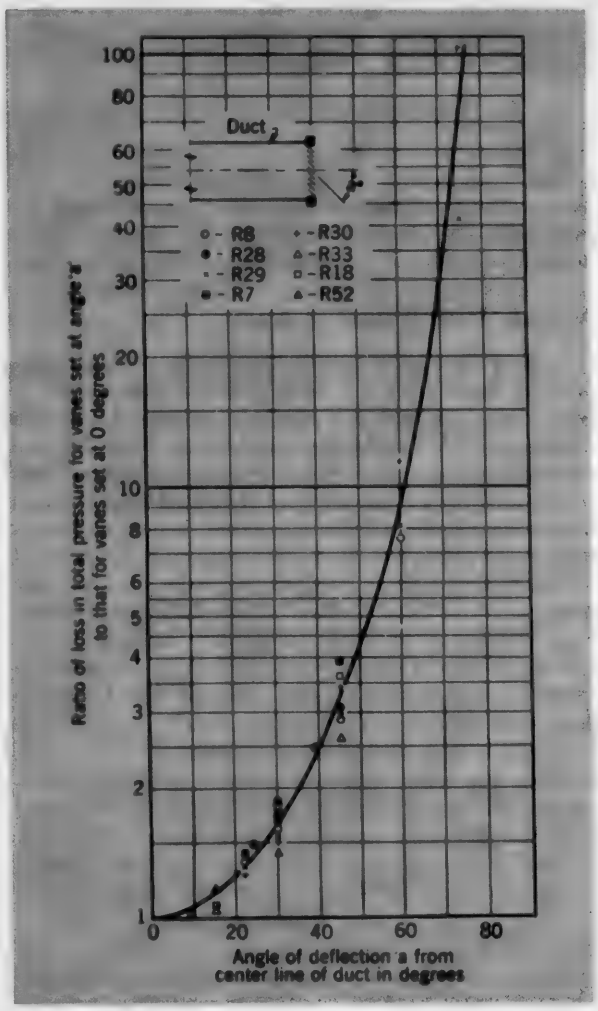

Duct 2
o - R8
• - R28
▪ - R29
• - R7
◇ - R30
△ - R33
□ - R18
▲ - R52
Ratio of loss in total pressure for vanes set at angle 'a' to that for vanes set at 0 degrees
Angle of deflection a from center line of duct in degrees

Fig. 22. Increase in pressure loss with different angles of deflection. Symbols represent different experimental runs. (U. of Ill. Eng. Exp. Sta. Bul. 342)

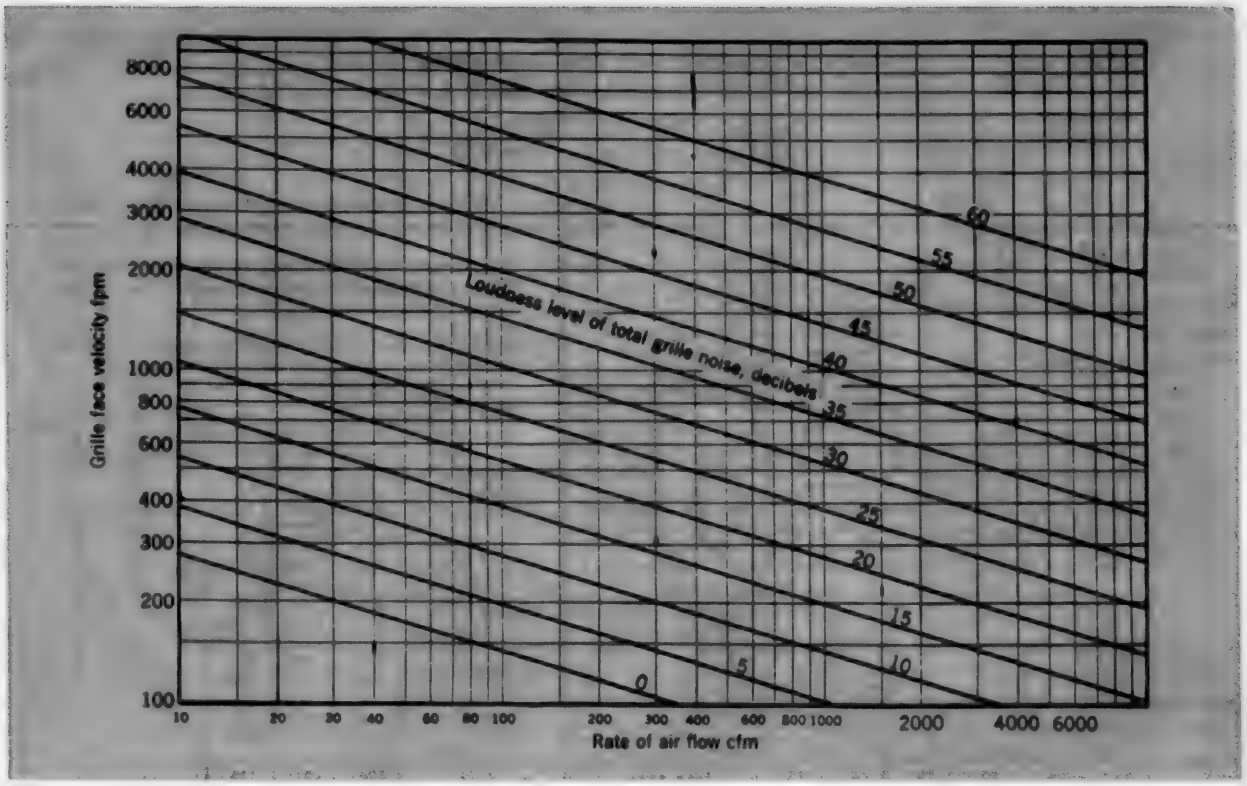


Fig. 23. Average loudness levels for registers with vertical and horizontal fins. (Data from Stewart and Drake)

the same velocity air may not extend to the far wall. In any case, these are hypothetical objections that have no proof as yet. Hence, unless better evidence exists that some other equation should apply, the modified version of the Tuve-Priester equation is offered for use. The data obtained from equation (7) has been incorporated in a design table, to be shown later.

Pressure Required at Register

For those installations in which relatively long throws of air are required at the register, an available pressure behind the register of 0.10 inch w.g. or more will be encountered. A search of a number of references, including manufacturer's catalogs, indicated the need of a summary table embodying complete performance characteristics of a wide range of register sizes. Wherever such data for a specific model are given in a catalog, they are preferred to any typical results derived for an average register.

In Fig. 21 is shown the relation between the free-area velocity and the total pressure head of the register, based upon tests of 22 commercial types of widely varying design in which *no air deflection* was used. The total pressure ahead of the register included not only the losses due to friction, turbulence, and expansion, but also the velocity head of the air leaving the register.

In Fig. 22 is shown the relation between the deflection angle and pressure loss, based upon tests conducted with eight different commercial types. The pressure loss increased relatively slowly when the deflection angle was increased from 0 degrees to about 15 degrees, but increased at a greatly accelerated rate for angles larger than 15 degrees.

The extensive data given in Bulletin 342 (Univ. of Ill. Eng. Exp. Sta.), part of which are shown in Fig. 21 and 22, as well as the data of Tuve and Priester, were incorporated in Tables C-1 and C-2. The working values in Table C-1 are for 22 degree deflection of air, and are for both register free area as well as total pressure requirements. These values are shown for various flow rates and for varying distances of the register from the opposite wall. The tabular values do not apply to any specific commercial type of register. Hence, where reliable data can be obtained from a manufacturer for a specific register, such data are preferred to the general information contained in Tables C-1 and C-2. An example of the use of Table C-1 is on page 122.

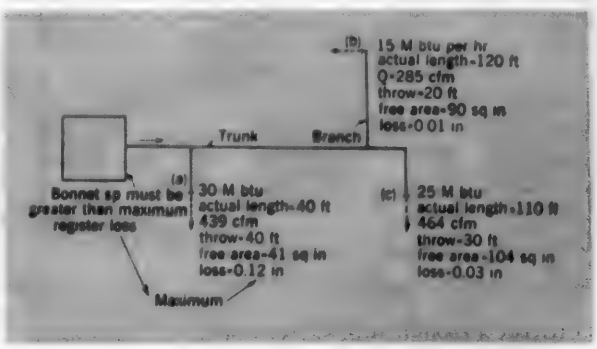


Fig. 24. Maximum register loss and its relation to duct loss and bonnet static pressure.

TABLE C-1.—REGISTER FREE AREA AND PRESSURE LOSS

22° DEFLECTION OF AIR

Upper Figure: Free Area, Sq Inches
Lower Figure: Pressure Loss, Inches W. G.

National Warm Air Heating and Air Conditioning Association

CFM	Reg. Size or Equivalent	Pressure Loss
Up to 59	10 x 4 10 x 6	.01 .01
60-69	10 x 6 12 x 4	.01 .02
70-99	10 x 6 12 x 6	.02 .02
100-119	12 x 6 14 x 4	.02 .02
120-129	12 x 6 14 x 6	.02 .02
130-169	14 x 6	.02
170-189	14 x 8	.02

NOTES

If register selected based on distance from register to opposite wall is unsatisfactory on account of size or pressure loss, it is permissable to shift one or more spaces left or right in the tables to obtain a more suitable register.

If requirements fall in blank space, select two registers in place of one and divide cfm capacity between the two registers.

Pressure loss is based on flat face adjustable bar type and does not include stackhead. For other type registers, consult Mfgrs. catalogs.

FOR FLOOR REGISTERS

Where a velocity of approximately 300 fpm is used, the free area = $\frac{\text{CFM} \times 144}{300}$ or approximately $\frac{\text{CFM}}{2}$.

Assume a pressure loss of .01.

CFM	Distance from Register to Opposite Wall								
	up to 10	10-21	22-24	25-27	28-30	31-34	35-39	40-49	50-59
190-209	68 0.02	49 0.03	38 0.05	29 0.08	24 0.11	19 0.16	Free Area Pressure Loss		
210-229	82 0.02	60 0.03	45 0.04	35 0.06	28 0.10	23 0.13			
230-249		71 0.02	54 0.04	42 0.06	34 0.08	28 0.11	22 0.17		
250-269		84 0.02	63 0.03	49 0.05	40 0.07	32 0.10	25 0.16		
270-299		100 0.02	76 0.03	60 0.04	48 0.06	38 0.09	30 0.13		
300-339			96 0.02	73 0.04	60 0.05	48 0.07	37 0.11		
340-379			122 0.02	95 0.03	78 0.04	61 0.06	47 0.09	33 0.18	
380-419				117 0.02	94 0.03	75 0.05	58 0.08	39 0.15	
420-459				142 0.02	113 0.03	91 0.04	70 0.06	47 0.13	
460-499				168 0.02	135 0.03	108 0.04	83 0.06	56 0.11	
500-539					159 0.02	126 0.03	97 0.05	66 0.10	
540-579					185 0.02	147 0.03	113 0.04	77 0.08	
580-619					212 0.02	169 0.03	130 0.04	88 0.08	51 0.16
620-659						192 0.02	147 0.03	100 0.07	59 0.15
660-699						217 0.02	166 0.03	113 0.06	75 0.13

A B

Values on the right of line A and A' should not be used in churches, auditoriums, concert halls, and such applications.

Values on right of line B and B' should not be used in residential work, motion picture theaters, court rooms, schools, and such applications.

CFM	Distance from Register to Opposite Wall						
	31-34	35-39	40-49	50-59	60-69	70-79	80-89
700-739	243 0.02	186 0.03	127 0.06	85 0.11	Free Area Pressure Loss		
740-779	271 0.02	208 0.03	141 0.05	94 0.10			
780-819		230 0.02	157 0.05	105 0.09			
820-859		254 0.02	173 0.04	115 0.08			
860-899		278 0.02	190 0.04	126 0.08			
900-939		304 0.02	207 0.04	136 0.07			
940-979		332 0.02	226 0.03	151 0.07	108 0.12		
980-1019		360 0.02	245 0.03	163 0.06	118 0.11		
1020-1059		390 0.02	265 0.03	177 0.06	127 0.11		
1060-1099			285 0.03	190 0.06	137 0.10		
1100-1139			307 0.03	204 0.05	147 0.09		
1140-1179			330 0.02	220 0.05	158 0.09		
1180-1219			353 0.02	235 0.04	169 0.08		
1220-1259			376 0.02	251 0.04	180 0.08		
1260-1299			401 0.02	167 0.04	192 0.07	136 0.13	
1300-1339			426 0.02	284 0.04	204 0.07	144 0.13	
1340-1379			452 0.02	301 0.04	217 0.06	154 0.12	109 0.22
1380-1419			479 0.02	319 0.04	230 0.06	163 0.12	116 0.21
1420-1459			508 0.02	338 0.03	244 0.06	172 0.11	122 0.20
1460-1500			536 0.02	356 0.03	256 0.06	182 0.10	129 0.19

A' B'

Given: a room that is 40 feet wide,
one register to handle 300 cfm air-flow rate,
and a deflection angle of 22 degrees to be used.

Solution: From Table C-1, a register having a free area of 37 sq inches and a pressure loss of 0.11 inch will handle the given requirements.

TABLE C-2.—REGISTER FREE AREA AND PRESSURE LOSS

NO DEFLECTION OF AIR

Upper Figure: Free Area, Sq Inches
Lower Figure: Pressure Loss, Inches W. G.

National Warm Air Heating and Air Conditioning Association

CFM	Reg. Size or Equivalent	Pressure Loss
Up to 59	10 x 4 10 x 6	.01 .01
60-69	10 x 6 12 x 4	.01 .02
70-99	10 x 6 12 x 6	.02 .02
100-119	12 x 6 14 x 4	.02 .02
120-129	12 x 6 14 x 6	.02 .02
130-169	14 x 6	.02
170-189	14 x 8	.02

NOTES

IF REGISTER SELECTED BASED ON DISTANCE FROM REGISTER TO OPPOSITE WALL IS UNSATISFACTORY ON ACCOUNT OF SIZE OR PRESSURE LOSS, IT IS PERMISSABLE TO SHIFT ONE OR MORE SPACES LEFT OR RIGHT IN THE TABLES TO OBTAIN A MORE SUITABLE REGISTER.

IF REQUIREMENTS FALL IN BLANK SPACE, SELECT TWO REGISTERS IN PLACE OF ONE AND DIVIDE CFM CAPACITY BETWEEN THE TWO REGISTERS.

PRESSURE LOSS IS BASED ON FLAT FACE ADJUSTABLE BAR TYPE AND DOES NOT INCLUDE STACKHEAD. FOR OTHER TYPE REGISTERS, CONSULT MFGRS. CATALOG.

FOR FLOOR REGISTERS

WHERE A VELOCITY OF APPROXIMATELY 300 FPM IS USED, THE FREE AREA = $\frac{\text{CFM} \times 144}{300}$

OR AXXPROXIMATELY $\frac{\text{CFM.}}{2}$

ASSUME A PRESSURE LOSS OF .01.

CFM	Distance from Register to Opposite Wall								
	Up to 21	22-24	25-27	28-30 A	31-34 B	35-39	40-49	50-59	60-69
190-209	62 0.02	47 0.03	37 0.04	30 0.06	24 0.09	18 0.15	Free Area Pressure Loss		
210-229	76 0.02	58 0.02	45 0.04	36 0.05	29 0.08	22 0.12			
230-249		69 0.02	53 0.03	43 0.04	34 0.07	26 0.11			
250-269		81 0.02	63 0.03	50 0.04	40 0.06	31 0.09	21 0.18		
270-299		93 0.02	73 0.02	59 0.03	47 0.05	36 0.08	24 0.16		
300-339			95 0.02	77 0.03	61 0.04	46 0.06	32 0.12		
340-379			120 0.02	97 0.02	77 0.03	59 0.05	40 0.10		
380-419				119 0.02	95 0.03	73 0.04	50 0.08		
420-459				149 0.02	114 0.03	88 0.04	60 0.07		
460-499				171 0.02	136 0.02	105 0.03	71 0.06		
500-539					160 0.02	123 0.03	84 0.05		
540-579					186 0.02	143 0.02	97 0.05	65 0.09	47 0.17
580-619					213 0.02	164 0.02	111 0.04	74 0.08	54 0.15
620-659						180 0.02	127 0.04	85 0.07	61 0.14

VALUES ON THE RIGHT OF LINE A AND A' SHOULD NOT BE USED IN CHURCHES, AUDITORIUMS, CONCERT HALLS, AND SUCH APPLICATIONS.

VALUES ON RIGHT OF LINE B AND B' SHOULD NOT BE USED IN RESIDENTIAL WORK, MOTION PICTURE THEATERS, COURT ROOMS, SCHOOLS, AND SUCH APPLICATIONS.

CFM	Distance from Register to Opposite Wall					
	35-39	40-49 A'	50-59 B'	60-69	70-79	80-89
660-699	210 0.02	143 0.03	95 0.07	69 0.12	49 0.22	
700-739	236 0.02	160 0.03	107 0.06	77 0.11	54 0.21	
740-779	262 0.02	179 0.03	119 0.06	86 0.10	61 0.18	
780-819	291 0.02	198 0.03	132 0.05	95 0.09	67 0.17	
820-859	320 0.02	218 0.03	145 0.05	105 0.08	74 0.15	
860-899	352 0.02	240 0.02	160 0.04	115 0.08	81 0.14	
900-939	385 0.01	262 0.02	175 0.04	126 0.07	89 0.13	
940-979	419 0.01	285 0.02	190 0.04	137 0.07	97 0.12	
980-1019	455 0.01	309 0.02	206 0.04	148 0.06	105 0.11	
1020-1059	493 0.01	335 0.02	223 0.03	161 0.06	113 0.11	
1060-1099	530 0.01	361 0.02	241 0.03	173 0.06	123 0.10	
1100-1139	571 0.01	388 0.02	258 0.03	186 0.05	132 0.09	93 0.17
1140-1179		416 0.02	277 0.03	199 0.05	141 0.08	100 0.16
1180-1219		446 0.02	297 0.03	214 0.04	151 0.08	107 0.15
1220-1259		476 0.02	317 0.03	228 0.04	161 0.07	116 0.14
1260-1299		507 0.01	338 0.02	243 0.04	172 0.07	122 0.13
1300-1339		539 0.01	359 0.02	258 0.04	183 0.07	130 0.12
1340-1379			382 0.02	274 0.04	195 0.07	138 0.13
1380-1419			403 0.02	290 0.03	206 0.06	146 0.12
1420-1459				308 0.03	218 0.06	155 0.10
1460-1500				324 0.03	230 0.06	163 0.10

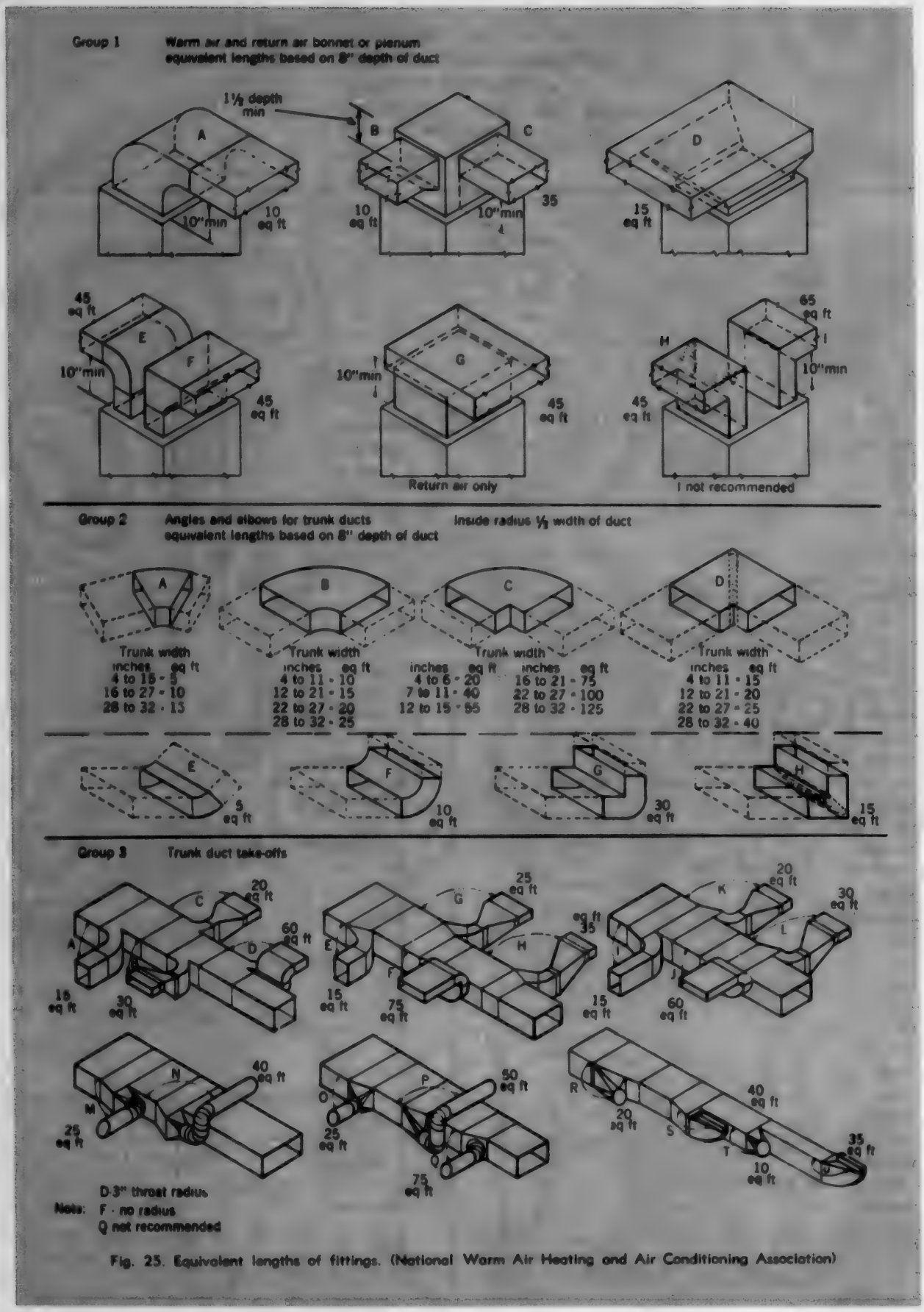
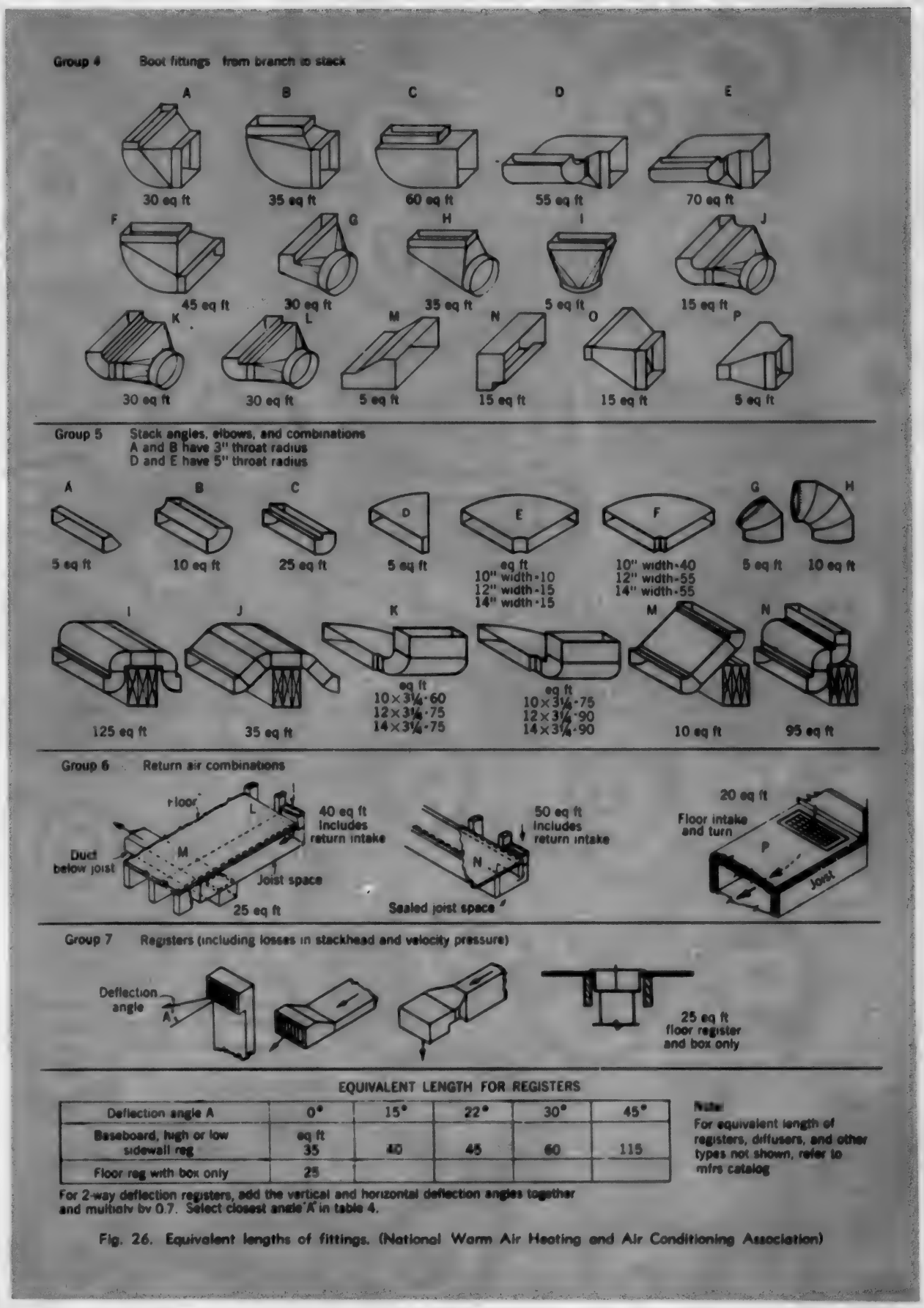


Fig. 25. Equivalent lengths of fittings. (National Warm Air Heating and Air Conditioning Association)



EQUIVALENT LENGTH FOR REGISTERS

Deflection angle A	0°	15°	22°	30°	45°
Baseboard, high or low sidewall reg	eq ft 35	40	45	60	115
Floor reg with box only	25				

Note:
For equivalent length of registers, diffusers, and other types not shown, refer to mfrs catalog

For 2-way deflection registers, add the vertical and horizontal deflection angles together and multiply by 0.7. Select closest angle 'A' in table 4.

Fig. 26. Equivalent lengths of fittings. (National Warm Air Heating and Air Conditioning Association)

TABLE D.—FREE AREA OF REGISTER SIZES
(Flat face, adjustable-bar type registers)

Nominal Size, In.	Free Area, Sq In. Approximate	Nominal Size, In.	Free Area, Sq In. Approximate
10 x 4	24	14 x 8	75
10 x 5	30	14 x 10	95
10 x 6	38	24 x 4	60
10 x 8	52	24 x 6	91
12 x 4	29	24 x 8	129
12 x 5	37	24 x 10	163
12 x 6	46	24 x 12	200
12 x 8	64	30 x 6	120
12 x 10	82	30 x 8	167
14 x 4	34	30 x 10	207
14 x 5	44	30 x 12	250
14 x 6	54		

This table is not complete and does not list all sizes being manufactured. For specific sizes and free areas, refer to register manufacturer's catalogs of those being used on each particular job.

Table D shows average free areas of registers for typical commercial types and should be used only when specific manufacturer's data are not available.

The heavy dividing lines in Tables C-1 and C-2 were included in an attempt to show distinction in sound level. For this purpose the work of Stewart and Drake on sound level was selected from a number of references consulted as the most practical for air conditioning work. The curves of Fig. 23 are based upon the results of tests by Stewart and Drake on registers with horizontal and vertical fins, and supercede those published in the original paper (ASHVE Tr. v. 43, p. 81).

It is possible to subtract the pressure required at the register from the total available at the bonnet and thereby obtain the pressure available for the duct system alone. For example, as shown in Fig. 24, if the pressure loss for register (a) is 0.12 inch w.g., for register (b) is 0.01 inch, and for register (c) is 0.03 inch, then the maximum pressure loss of the registers is 0.12 inch. The required bonnet pressure must be greater than 0.12 inch. If, for example, the bonnet pressure selected is 0.25 inch, then the available pressure for overcoming resistances in each of the ducts from the bonnet to the register will be for (a) 0.13 inch, for (b) 0.24 inch, and for (c) 0.22 inch.

Return Intake Sizes

As indicated previously, the location of the return intake is not as critical as the locations of the warm-air registers. The air flow from more than one register can be handled through a single return intake. If uniform room-air temperatures are maintained by the proper placement of registers, then the return intakes can be located in the ceiling as well as in the sidewall or in the floor. Usually floor locations are not favored because the intakes will be stepped upon.

Theoretically, the air-flow rate in cfm at the register is greater than that at the return intake because of the less dense air at the supply register. In actual practice the difference of 10 to 15% is not considered material. Furthermore, if the flow rate at the registers is considered to be the same as that at the return intakes, the design of the return duct system will be conservative. Hence, the air flow to be handled by any given return intake is obtained by adding the flow rates for all of the registers in that part of the space. For example, suppose that eight warm-air registers, each handling 150 cfm, are located in a large space, or a total of 1200 cfm of air. Assume that two return intakes are to be located in the space. Then the air-flow requirements of the two return intakes can be any combination that will total 1200 cfm.

TABLE E.—RETURN INTAKE SIZES AND CAPACITIES

Nominal Size, In.	Approximate Capacity, CFM	Nominal Size, In.	Approximate Capacity, CFM
10 x 4	100	24 x 4	260
10 x 5	125	24 x 5	320
10 x 6	155	24 x 6	390
10 x 8	215	24 x 8	490
12 x 4	120	24 x 10	665
12 x 5	155	24 x 12	795
12 x 6	190	30 x 4	300
12 x 8	260	30 x 5	400
12 x 10	325	30 x 6	485
14 x 4	145	30 x 8	660
14 x 5	180	30 x 10	830
14 x 6	220	30 x 12	1015
14 x 8	305	30 x 14	1160
		30 x 16	1355

This table is not complete and does not list all sizes being manufactured. For other sizes and exact free areas refer to register manufacturer's catalogs.

Free area requirements of baseboard or floor intakes for any capacity can be determined by the following equation:

$$\text{Required free area, sq. in.} = \frac{\text{Required capacity, cfm}}{500} \times 144 = (0.288)\ (\text{cfm}).$$

A suggested design value for return intakes is 500 fpm through the free area. On this basis the values for Table E were derived.

Sizes of Ducts and Equivalent Lengths of Fittings

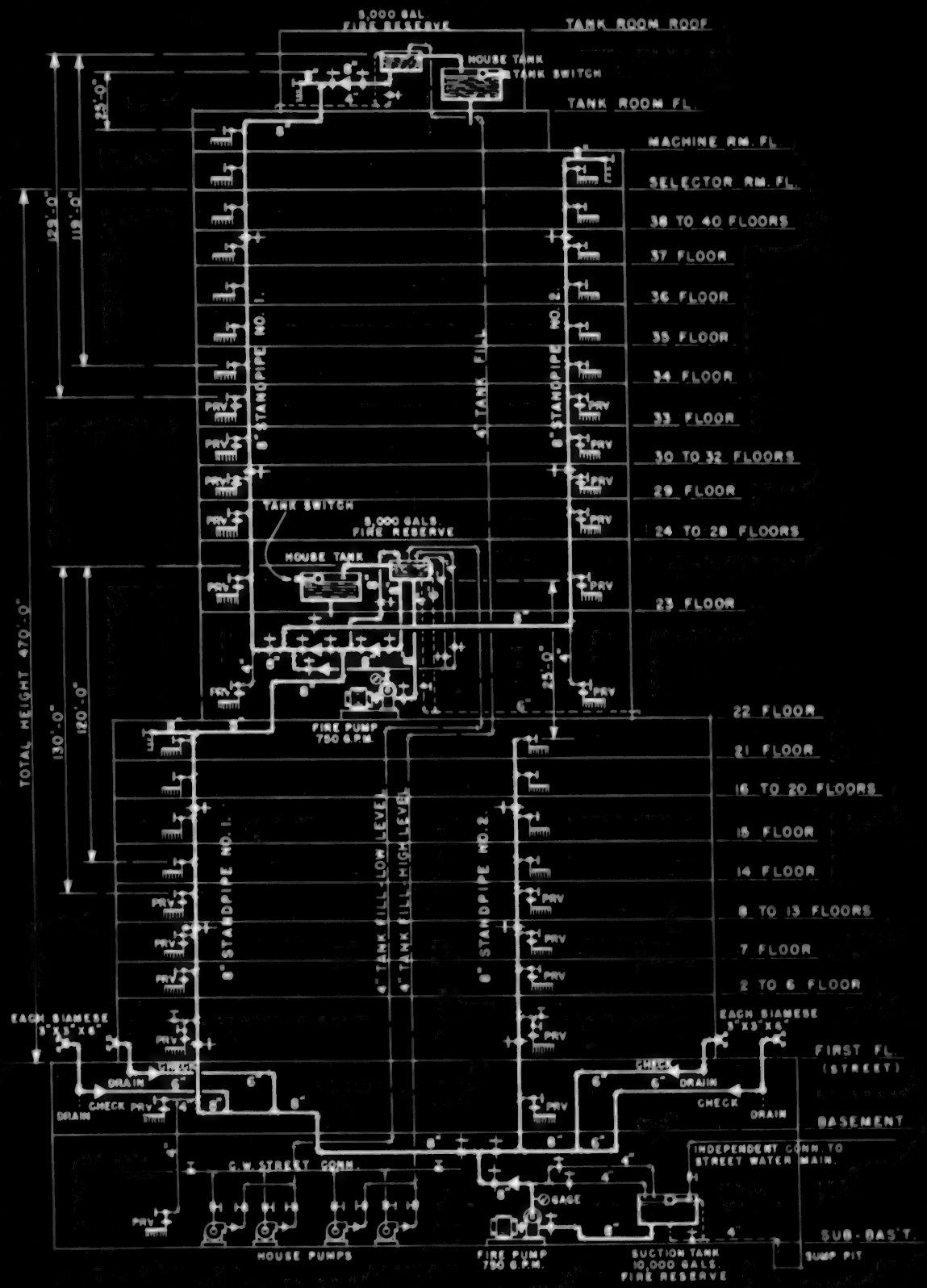
Once the total loss in pressure for each run has been determined, the selection of the "friction loss per 100 ft of duct" for each run can be determined by:

$$\frac{\text{Available pressure for each run in inches of water}}{\text{Effective lengths of duct from bonnet to register in units of hundreds of feet}}$$

Now the "effective length of duct" is the summation of the "straight lengths" of duct and the "equivalent lengths" of fittings in each run. For the purpose of determining the equivalent lengths of fittings commonly used in forced-air systems, the values in Fig. 25 and 26 are shown. The values, which are in "equivalent feet of straight duct" are only approximate, and are on the low side for extremely large ducts over 18 inches in diameter, or 18 inches square.

The design procedure from this point forward is no different from that commonly referred to as the "equal friction pressure loss" method. For each branch duct in the system, both the cfm to be handled as well as the friction loss per 100 ft of duct will be known. By means of the common air friction chart for air flow, the size of the ducts can be determined as well as the duct velocity. By means of tables or charts, the round pipe diameters can be converted to rectangular or square pipe sizes that will have the same friction loss characteristics.

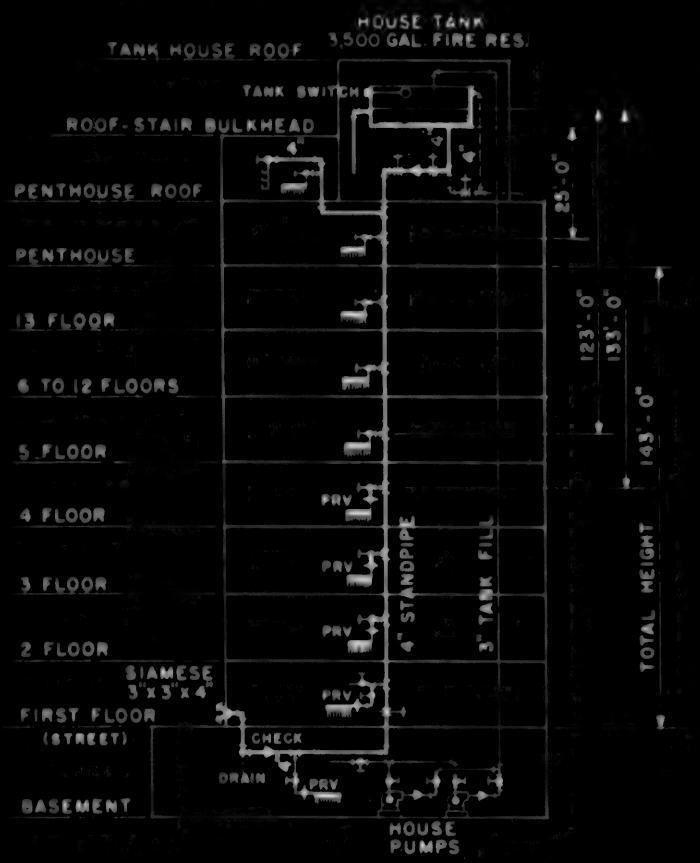
STANDPIPE SYSTEMS



STANDPIPE SYSTEM WITH INTERMEDIATE TANKS

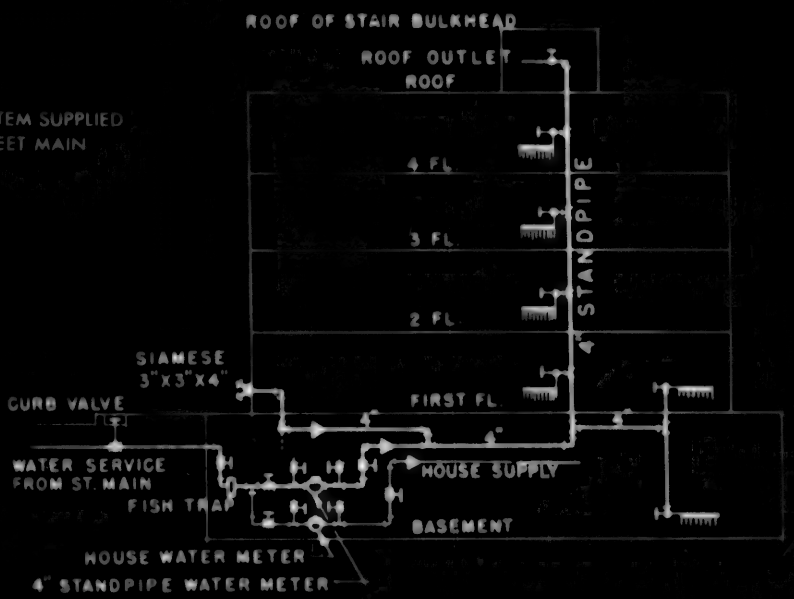
CUT ALONG THIS LINE

STANDPIPE SYSTEMS



SINGLE STANDPIPE SYSTEM SUPPLIED FROM A ROOF TANK

DRAWINGS THROUGH THE COURTESY OF MORTIMER FREUND OF LaROE, FREUND AND CAMPBELL HEATING ENGINEERS



STANDPIPE SYSTEM SUPPLIED FROM A STREET MAIN

LOUIS BLENDERMANN ON

PIPING AND PLUMBING

Increasing Water Supply Pressure in Buildings

EVERY new building under construction, regardless of its size, demands a water supply of good quality and ample pressure. Good quality means water that is bacteriologically pure and of acceptable appearance and taste. Ample pressure means water supplied to the various fixtures and equipment in the building at a pressure that will provide a steady flow to fulfill the needs of the fixtures and equipment despite the number of fixtures that may be used at the same time.

Since water of sufficient pressure is not always available at a given site, consideration must be given to means that can be employed to boost pressure within the building. Several methods that are more commonly used to serve this purpose will be described.

Street Mains With Inadequate Pressure

An engineer frequently finds that a project which he is helping to design will be served by a street main with pressure so low that the main cannot supply the entire needs of the building. When this occurs, the underlying reason for the low pressure in the street main can usually be attributed to one of the following factors:

1. Existing low pressure water distribution system.
2. Street main of variable pressure, undersized piping.
3. Mains overtaxed by the increased number of new buildings.
4. Mains that are old and low pressure is purposely maintained to prevent rupture of piping.
5. Partial stoppages by foreign objects or tuberculation in the water distribution system that tend to reduce the pressure.
6. Summertime load—large volumes of water used by the public and by equipment such as air conditioning units.

Importance of Adequate Water Pressure

In modern construction, just the mere flow of water, no longer suffices the building needs. A dependable flow and an adequate pressure is a necessity (1) because it lessens the possibility of back-siphonage in a part of the interior water supply system; (2) the greater number of flush valves that are installed require prescribed pressures for their proper function; (3) the public uses more water and the various fixtures and equipment utilizing water are dependant on a water supply that has steady flow and constant pressure to produce the desired results.

For these and many more reasons, careful consideration must be given to the water supply for a proposed project, especially when an inadequate water pressure prevails in the street main.

Methods of Increasing Water Pressure

When low water pressure is experienced, the engineer has several methods from which he may choose to increase the pressure. The method chosen of course is dependent

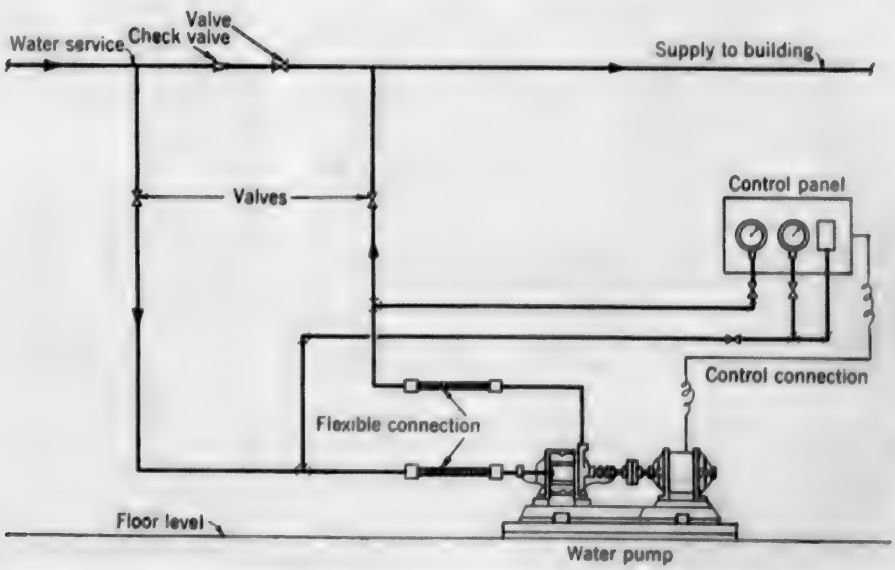


Fig. 1. Typical arrangement of tankless water supply system.

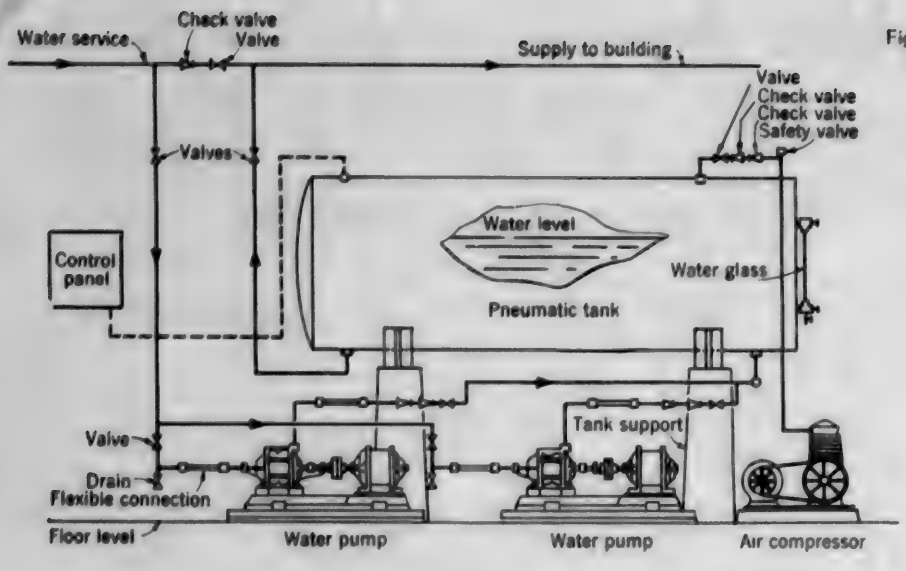


Fig. 2. An arrangement of a typical pneumatic tank system.

upon the specific demand requirements of the building or nature of his proposed design.

Although there are numerous ways in which this may be accomplished, we shall confine ourselves to just three of the more generally used methods. These follow:

1. Tankless water supply system.
2. Pneumtaic tank water supply system.
3. Roof tank using house pumps.

Tankless Water Supply System

A tankless water supply system serves its function best in a building where small quantities of water are used but the water pressure in the street main is insufficient to fulfill the demand requirements.

By means of a pump tied into the line, the required pressure is built up and maintained. Figure 1 shows a typical layout of the pump and piping hook-up necessary for such a system.

It will be noted in this figure that the water supply line leads directly to the fixtures, with a branch taken from the line and connected to the pump. The system operates as follows:

Suppose a building requires a water pressure of 40 psi and the available water supply varies between 30 and 40 psi, depending upon other factors that draw on the water in the street main. While a pressure of 40 psi is flowing through the interior piping system, the pump is inoperative. However, once the pressure drops to say 35 pounds, a pressure switch is activated which starts the pump and this builds up the desired water pressure. A check valve is placed on the bypass line to prevent the pumped water from backing up into the supply line. Flexible connections are installed between the pump and the piping to prevent the pump vibration from being transmitted through the piping system. In addition, the pump is supported on a cushioned base and this is in turn anchored to the floor slab.

The pump capacity is selected on the basis of the building needs. If a more dependable pumping arrangement is sought, duplex pumps are used. When this system is carefully designed and adequately sized for the needs of the particular building, it can be counted upon for satisfactory service. A disadvantage is that the water will be furnished to the fixtures as a throbbing supply due to the action of the pump.

Pneumatic Tank Water Supply System

For larger buildings with greater water demands, where a constant pressure is desired, a pneumatic tank system is employed. Here again, the water is supplied directly to the fixtures with a branch taken from the water main and connected to the pneumatic tank system. The water pressure is built up by the pumps and tank, thus assuring a steady flow of water throughout the building. Figure 2 shows a typical arrangement of tank, piping, air compressor and component apparatus.

As illustrated, the water supply bypasses the pneumatic tank system but a branch from the water supply is connected to the pump suction. The discharge from the tank is reconnected back to the supply for the fixtures.

The pump or pumps force the water directly into the storage tank which is partially filled with a volume of air at a prescribed pressure maintained by the air compressor. The water in the tank occupies approximately two-thirds the capacity of the tank. The water level in the tank is shown on the water glass. Since the water is pumped into the tank under pressure, it will further "squeeze" the compressed air which is the force that acts to furnish the water in the amount and pressure needed for the height and water demand of the building where it is installed.

The size of the pneumatic tank, pumps and related equipment is determined by the size or height of the building and potential water demand.

A pneumatic system has the advantage that it can be installed in the building at basement level and is used for an upfeed water distribution system for the cold water as well as the hot water. This system when properly designed and installed can be counted upon to service efficiently the needs of the building. In very tall buildings an intermediate pneumatic tank system is installed at an upper floor level to sectionalize the water distribution systems. A disadvantage of the system is that a considerable amount of space is required for the equipment to fulfill its function. Moreover, if a fire standpipe system is contemplated, a fire pump must be installed.

Roof Tank System

A roof tank system, like the pneumatic tank system, is used in buildings where large volumes of water are needed for the demand requirements. The tank is located above the roof level of the building and is filled by means of house pumps located on the ground floor or in the cellar of the building. A typical system is shown in Fig. 3.

The roof tank is located at a level above the roof and at a height calculated to maintain the needed pressure at the top floor level of fixtures and equipment. The size of the roof tank is determined on the basis of the volume of water in gallons per minute that will be used in a given time.

House pumps are usually of the duplex type and are sized for the capacity that will furnish the required amount of water to satisfy the desired pumping cycle.

If the roof tank is to be used for both the fire and domestic water needs, the tank must be sized to hold at least 3500 gallons of water for fire reserve in addition to the domestic water reserve. The domestic water reserve is estimated by either the pumping cycle desired of the pumps or by the gallons of water to be held in reserve, should the water supply fail or drop. Some engineers in their design figure reserves that will last anywhere from 15 to 30 minutes of normal consumption, depending upon the type of building served.

The water level is maintained in the tank by means of a ball float valve. Many varied types of valves are available for this purpose. An actuating switch, an integral part of the valve, starts and stops the pumps. Here again, various types of switches are available for this purpose.

The roof tank can be constructed of steel or of wood. Also, it consists of just one compartment or several compartments, depending upon the particular design favored by the engineer. A properly designed roof tank system is an efficient system and will serve, in a troublefree manner, the needs in a building of several stories or tall buildings of many stories.

The disadvantage of a roof tank system is the periodic cleaning required to maintain a taste-free water. To this end the water in the tank will remain cleaner for longer periods if the entire water reserve in the storage tank is circulated. This circulation may be accomplished by the proper arrangement of piping comprising the down feed supply in the tank.

When a system is selected for use in a particular application, the equipment manufacturers should be consulted with regard to the proper type to use and the hook-up recommended.

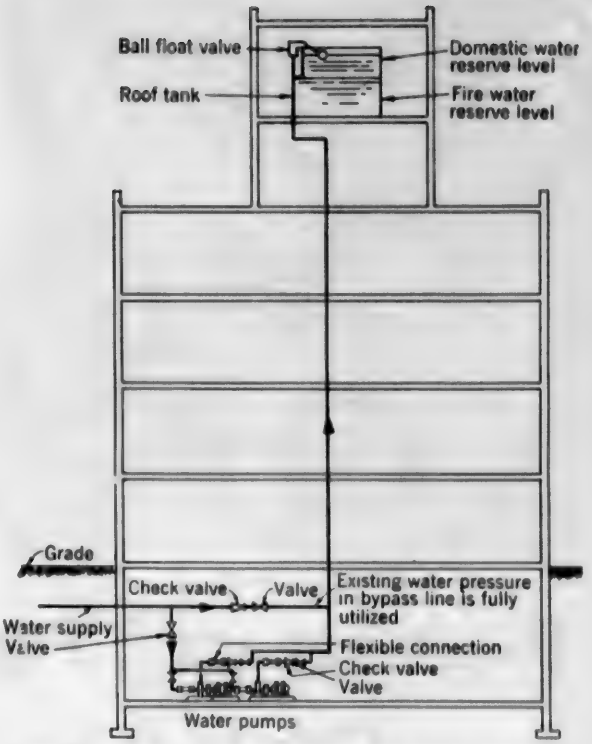


Fig. 3. Arrangement of roof tank water supply system.

Air Conditioning Important for Food Stores

Food retailers pay for air conditioning whether or not they install it in their stores, according to the official publication of the National Association of Retail Grocers. Pointing out that a decrease in sales volume and increased spoilage of perishable foods during the hot months are direct business losses resulting from lack of air conditioning, the article states:

"With a comfortable, cool store, customers will come in oftener, stay longer, and purchase more items. Employees are more efficient and pleasant. Refrigerated cases are not overtaxed and meat and produce stay fresher. Also shelves and stock stay cleaner longer."

Bright sun rays beaming through a large plate glass window can overwork any air conditioner, the article warns. A canopy installed over a large display window can reduce the retailer's air conditioning needs by 10% or more. If walls are exposed to bright sunlight, strategically placed trees will add to the appearance of the location and reduce the cooling load needed. "If this is not practical," the article continues, "try painting walls a light color. Tests show a saving of from 10 to 50% (depending on the construction) in the heat gain through light colored walls versus dark walls."

Insulation and a double vestibule serve a year round purpose, beneficial for heating and cooling periods and a pitched roof requires about one-third less cooling than a flat roof. A coating of white marble chips on a flat roof will drop the cooling requirements to that of a pitched roof.

"Any nationally advertised system will give good service. In a recent test by the air-conditioning industry of 22 coolers, only one proved ineffective. This test also showed that proper installation was most important for successful and quiet operation. The unit must be properly sized, control wiring correctly installed, ducts through uncooled areas, insulated.

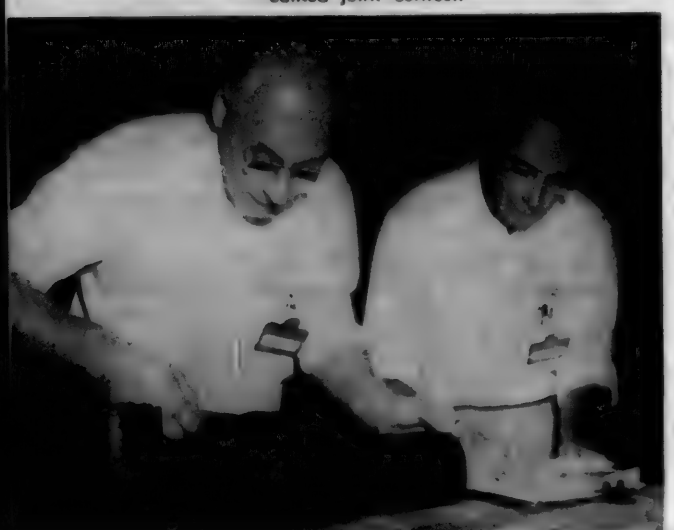
"Tests show constant operation is the key to good humidity control. Two or more smaller units which can be run separately or together may result in operational savings. One unit runs continuously and as the heat load or humidity increases, the other units go into operation."

(Left) Part of a contingent of plumber and pipefitter apprentices, apprentice instructors and union personnel emerging from Purdue's Union building between classes during the 1955 conference and contest sponsored by the United Association.

2nd Annual Plumber and Pipefitter Apprentice Contest and Conference

(Above) Apprentice Andrew O'Donovan, Jr., Local 250, Los Angeles, sweats a copper joint under watchful eye of Dean W. A. Knapp of Purdue and Arthur I. Heim of Copper and Brass Research Association.

(Below) Frank Peterson and Homer Robertson tally entries in calked joint contest.



PURDUE University, Lafayette, Ind., was host at a 5-day plumber and pipefitter apprentice conference and contest, August 15-20, arranged by the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada under direction of Purdue's Industrial Education Division. Proceedings included a forum on peacetime uses of atomic energy arranged by U. A. President Martin P. Durkin, former Secretary of Labor.

Attendance at the conference numbered over 800 officials and members of the union, and also included representatives of government agencies, contractors, manufacturers, and trade associations. A total of 31 industrial firms and associations supplied exhibits.

A. M. Gegenheimer, field project engineer of Blaw-Knox Company, St. Louis, Mo., told the atomic energy forum that Atomic Industrial Forum, Inc., forsees a reactor piping business of $26 million in 1959 increasing to $37 million in 1961 and $97 million in 1963. These amounts, said Gegenheimer, are only for piping materials and labor in place, and do not include any auxiliary facilities, such as water treating systems.

Other conference activities included a five-day training course for apprentice instructors under the direction of Purdue's Industrial Education Division. The course attracted 176 apprentice instructors who were presented certificates at a luncheon on Saturday, August 20.

As a major part of the week's activities, the U. A. held the international finals of its second annual apprentice contest. Seventy-four apprentices, 40 plumbers and 34 pipe fitters, all in the fifth and final year of their training, and each a champion in his own state or province, competed for the honor of being best of their class for the United States and Canada.

Results of the apprenticeship contest were announced

Annual International Apprentice Contest

and EDUCATIONAL CONFERENCE

Purdue University ✦ 1955

(Above) Winners of apprentice contest receive awards at dinner. L to r, 3rd, 2nd, and 1st place plumbers David Binns, Lynn F. Wallace, and Jack F. Goold, respectively; V.A. General Secretary-Treasurer Edward J. Hillock, Assistant to the General President Peter T. Shoemann, Assistant Secretary William C. O'Neill; and 1st, 2nd, and 3rd place pipefitters Thomas Tobin, Jr., Anthony P. Bielski, and Walter D. Swanson, Jr., respectively.

(Left) Apprentice instructors training course is taken by 176 delegates.

at a dinner held in the North Ballroom of the Purdue Memorial Union Building on Thursday evening, Aug. 18.

The winners:

Plumbing

First Place—Jack F. Goold, Aurora, Colorado, Local Union 3.

Second Place—Lynn F. Wallace, Houston, Texas, Local Union 68.

Third Place—David Binns, Seattle, Washington, Local Union 32.

Pipe Fitting

First Place—Thomas J. Tobin, Jr., Philadelphia, Penna., Local Union 420.

Second Place—Anthony Bielski, Yonkers, N. Y., Local Union 638.

Third Place—Walter D. Swanson, Jr., Omaha, Nebr., Local Union 464.

Peter T. Schoemann, assistant to U. A. General President Martin P. Durkin, presented a check of $1,000 to each of the first-place winners. Prizes of $500 and $250 were presented to each of the second and third-place winners respectively.

Robert T. Morrill, president of the National Association of Plumbing Contractors, and Edward Jungbert, president of the Mechanical Contractors Association of America, addressed the dinner gathering and presented prizes to the winning contestants.

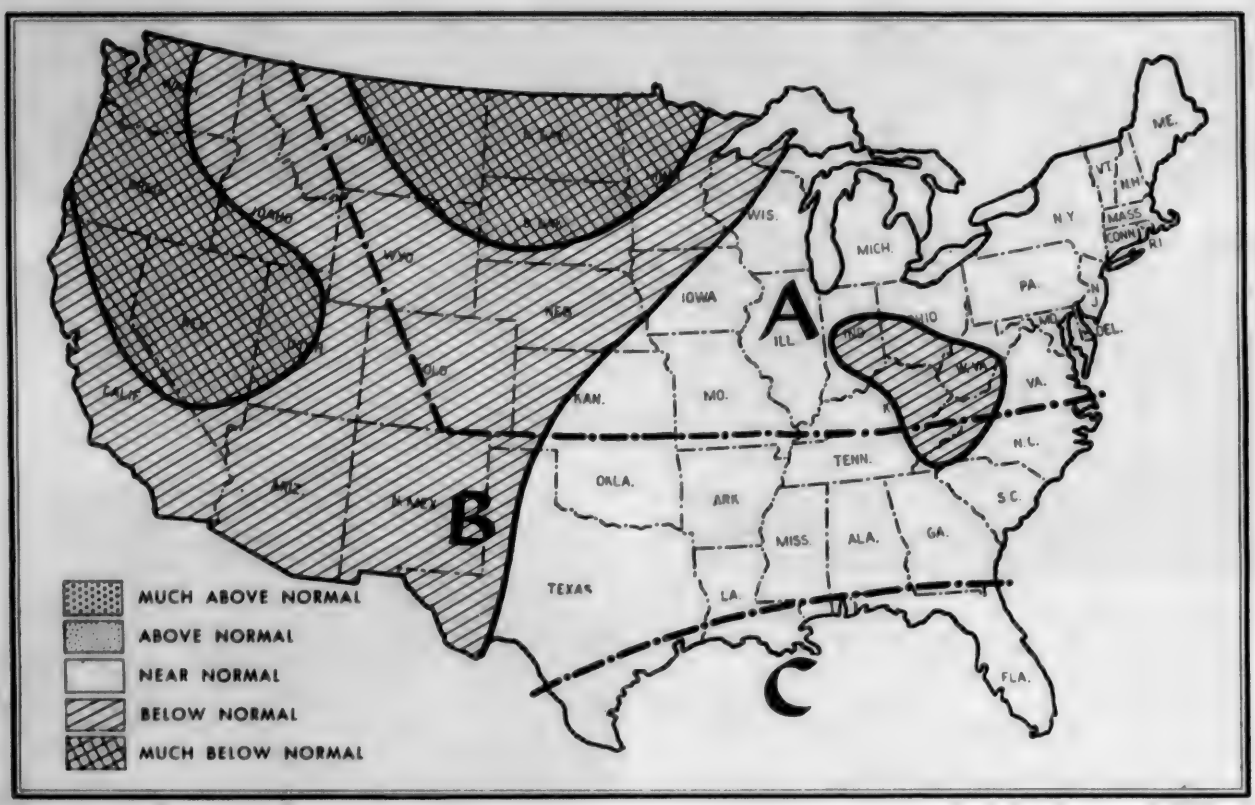
The international apprentice training program in the plumbing and pipe fitting industry is jointly administered by the U. A., the two contractors' associations, and the National Association of Master Plumbers and Heating Contractors of Canada.

(Above) Executive meeting of United Association.

(Below) Apprentice J. Robert Bick, Local 392, Cincinnati, makes a cut in the welding project.

Temperature Forecast for October

Prepared for Air Conditioning, Heating and Ventilating by Long Range Weather Consultants



KEY BY REGIONS

	A	B	C
NEAR NORMAL	+1° to −1°	+1° to −1°	+1° to −1°
BELOW NORMAL	−2° to −4°	−2° to −4°	−2° to −3°
MUCH BELOW NORMAL	−5° or more	−5° or more	−4° or more

OVER most of the eastern half of the country the temperature will average rather close to the normal for the month of October. There will be a tendency for the temperatures to run a degree or two above normal from Pennsylvania northeastward through New England, and a degree or two below normal in the southern Appalachians and along the south Atlantic coast. In most eastern sections warmer weather (relative to the normal) is expected during the early part of the month, cooler weather during the latter part.

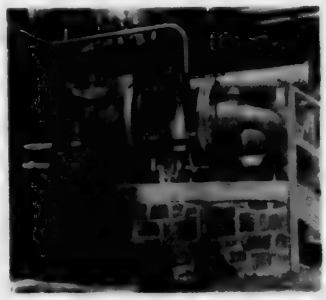
Except for a strip from Kansas southward through eastern Texas, which will be close to normal, the western half of the country, including Minnesota will be cool, at least 2° below the normal, during October, with most of the month below normal. Sections of the northern plains, including most of the Dakotas, northern Minnesota and eastern Montana are expected to average as much as 5°, or much below normal. Equally cold weather is expected in some central and northerly sections west of the Divide, including most of Nevada, Oregon and western Washington. The month probably will start cold and continue cold in this far western area.

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on page 153 for securing additional information on new equipment and materials described in this department.

Outdoor Water Chillers

The CenTraVac line of centrifugal water chillers is now available for outdoor installation without protective enclosures from The Trane Co., Las Crosse, Wis. All sizes from 50 to 800 tons refrigeration capacity can be obtained with this optional feature.



Hermetic construction and automatic operation make the chillers suitable for outdoor use with only minor modifications. The purge unit, control panel, conduit boxes and capacity control mechanism are weatherproofed and provided with electric heaters to prevent condensation. The insulation is waterproofed, and suitable weather-resistant paint is used on the exterior.

The outdoor version of the chiller was developed mainly for use in large existing buildings and industrial plants. Often the installation of centrifugal refrigeration equipment is impossible, unless it can operate safely and satisfactorily outside on ground level, at some intermediate location or on the building roof.

Many industrial plants requiring chilled water for comfort air conditioning or process applications prefer to be able to install the refrigeration equipment out-of-doors in order to gain maximum use of productive floor space.

More information? Circle Item 1 on postcard, page 153.

Portable Foot Warmer

A portable foot warmer called the Electro-Mat is introduced by Interstate Rubber Products Corp., Los Angeles, Calif., to add to employee comfort and as an aid in cutting absenteeism caused by common colds, back aches, and sore muscles.

The foot warmer is an electrically-heated, Neoprene rubber mat 14 x 21 in. It is designed to help increase efficiency and lower the frequency of colds of office personnel and production line workers. The mat transmits heat which reduces the common complaint of cold feet often heard in offices and plants.

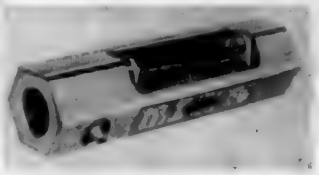
Consuming less power than a 100 watt light bulb, the mat is used by check stand cashiers, secretaries, assembly line workers, housewives, warehouse workers, theater cashiers, office personnel, and machine operators.

More information? Circle Item 2 on postcard, page 153.

Heating-Cooling Balancer

A liquid flow indicator designed for balancing warm water heating and chilled water cooling systems is announced by Bell & Gossett Co., Morton Grove, Ill.

Called the Thermoflo balancer, the unit is practical to use on small installations, such as a radiant panel heating system, snow-melting system, or any zoned water circuit. The balancer indicates the water flow rate through a circuit up to 10 gpm. A valve is built in to adjust the flow rate to the desired setting. A thermometer is also included and is visible through the sight glass.



By visually checking the water flow rate in gpm, a system can be balanced once. Return trips by a contractor are unnecessary since the flow rate through different circuits is proportioned for individual heating or cooling loads.

The flow indicator, although designed for warm water and chilled water circulating systems, can also be used in various industrial fields.

More information? Circle Item 3 on postcard, page 153.

Filters for Dust Collector

Filtration through six throwaway filters is one of several features of the after-filtering mechanism designed for the Model 219 FM-A, cyclone-type, dust collector by Torit Mfg. Co., St. Paul, Minn.

Used to collect dust, lint, chips, powders, and fumes in industrial plants, the unit recirculates filtered air back into the room to prevent heat losses during cold weather. Its 5-hp, 3450-rpm motor pulls 2100 cfm of air through an 8-in. inlet at a static pressure of 3.0 in. of water and an air speed of more than a mile a minute.

Depending upon the particle's size and specific gravity, the efficiency of the unit's centrifugal action varies from 75% to 95%. Thick pads of glass insulation wool on each of two open surfaces on the after-filter frame remove any fine dust that has not already been trapped in the collector's 4½ cu ft, internal reservoir.

Each filter is held to the frame by six wing nuts, which may be removed for replacing material. The frame is made of 20-gage steel with a blue-gray wrinkle finish.

The dimensions of the collector are: height, 93¼ in.; depth (less after-filter), 30 in.; width, 24 in.; and shipping weight, 635 lb. The after-filter measures 81 x 51 x 14 in.

More information? Circle Item 4 on postcard, page 153.

Machine Bores Under Walks

An underwalk and driveway tool that bores holes is announced by Mall Tool Co., Chicago, Ill. The vibratory earth borer is powered by a gasoline engine.

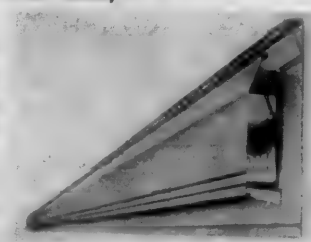
Without removing any soil, the earth borer makes a 2-inch diameter hole straight through the soil, under concrete sidewalks, and driveways. The borer head stays on a level course in order to provide an easier and quicker method of laying underground piping and wiring. The machine helps to eliminate the bottlenecks, confronted in laying pipe and conduit under sidewalks, drives, and runways.

A feature of the power borer is that its rubber tire wheels allow it to be rolled from one place to another on a wheelbarrow mounting. One man wheels, while another carries the boring head and flexible shaft.

More information? Circle Item 5 on postcard, page 153.

Baseboard Made Slimmer

A new line of baseboard radiation featuring a 1-in. copper tube element in a new enclosure is introduced by Brown Products Corp., Forest Hills, N. Y.



Called Bayce-Heet, the baseboard line has a maximum depth of 2¼ in. It can be recessed for greater shallowness of depth in the finished installation.

Integral dampers are built into each 8-ft. section at the factory, so that contractors do not have to order dampers separately and install them on the job.

Another feature intended to simplify the baseboards' installation is a hanger bracket that slips into pre-cut slots in the back enclosure. Measuring to locate studs is unnecessary, and, as the slots provide positive support at two points on the bracket, no screws or other fastenings are needed.

The hangers are dipped in plastic to minimize the noise caused by expansion and contraction. Holes for nails to secure the back enclosure to studding are drilled on 16-in. centers.

More information? Circle Item 6 on postcard, page 153.

Asbestos Sheet Packing

An asbestos sheet packing is made by Thermoid Co., Trenton, N. J., to handle the gasket requirements of industrial plants, mines, railroads, ships, and institutions.

Designated as No. 90 sheet packing with a gray-black color, it is suitable for handling steam, hot and cold water, brine, air, and oil up to 300 psi and 500 deg F. The average tensile strength of cross-laminated material is 4500 psi and for homogenous packing 3000 psi. It consists of 70% ash with a 2% water absorption.

The packing is made in three thicknesses, 1/32, 1/16, and 1/8 in., and in three sheet sizes, 48 x 48 in. (cross-laminated or homogenous), 48 x 72 in. (homogenous), and 48 x 144 in. (homogenous). The material weighs 2.6 lb per sq yd in the 1/32 in. thickness.

More information? Circle Item 7 on postcard, page 153.

Valve Is 3- or 4-Way Control

A multiport, lift-and-turn valve is being made by Aqua-Matic, Inc., Rockford, Ill.

Called Solomite and made of brass, the valve is 3-in. across and about 2 in. deep. It is a miniature version of its larger counterpart, the company's Solo valve.

The valve changes 4-way or 3-way circuits by lifting the handle and turning it to drop into the proper slot. Its design features include an O-ring seal on the stem shaft and a forged handle, cap, and bonnet. It is available only in a ¾-in. size.

While the valve is designed primarily for top-salting domestic water softeners, it is also applicable to other piping systems or applications requiring 2-position or 3-position control of 3-way and 4-way circuits.

More information? Circle Item 8 on postcard, page 153.

Heaters Get New Motors

Permanent, split capacitor motors are offered on all heaters of 175,000, 200,000, and 225,000 Btu per hr capacity by Janitrol Heating and Air Conditioning Div., Surface Combustion Corp., Columbus, Ohio. The unit heaters are propeller-type, gas-fired heating units with constant speed motors.

Failures in the starting mechanism of split phase motors used formerly was a major cause of service calls. The company now feels that service calls originating in motors will be reduced. A field testing program conducted by the motor manufacturer involved more than 25,000 motors of the new design. They have been found to start without the sudden starting noise experienced with the former motors.

Normal variations in line voltage do not adversely affect the motor speed, with the result that the volume of air delivery remains constant. The motors are equipped with built-in thermal overload protection.

The permanent split capacitor motors are manufactured by the motor manufacturer to meet the requirements of the three largest propeller-type unit heaters. Shaded-pole motors having many similar advantages are used on the six smaller sizes of the company's unit heaters.

More information? Circle Item 9 on postcard, page 153.

Piston-Type Flush Valve

A piston-type flush valve, the Metro, is being produced by the plumbing division of Kohler Co., Kohler, Wis.

Designed to work at pressures ranging from 6 to 120 lb, a touch in any direction on the valve's handle trips it for normal, positive flush and refill. The length of each flushing action and water volume are regulated by accessible adjustment screws which coordinate the water pressure and volume.

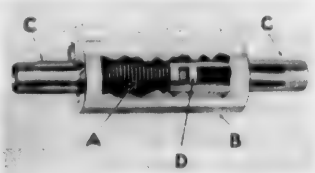
Excessive water use due to holding or wedging the handle in a tripped position is prevented, since a normal flushing action results no matter how long the handle is depressed. A surge of water through the valve passageways an instant before each flushing action removes foreign particles to assure thorough operation.

Like other fittings in the company's line, the valve is constructed of chromium-plated brass. The cap and flush handle are sealed with O-rings.

More information? Circle Item 10 on postcard, page 153.

Riser Expansion Compensator

An expansion compensator for vertical heat-riser lines is being made by Flexonics Corp., Maywood, Ill.



Known as the Model H, the expansion compensator has a two-ply stainless steel bellows (A) as the pressure carrier and it is enclosed in a steel housing (B) with steel pipe nipples (C) on both ends. A positive anti-torque device (D) is built in to provide against possible damage to the bellows element during installation. The design of the unit enables it to be placed in any wall without the need for access panels or special construction.

Available in NPT sizes from ¾ to 3 in., the compensator will take pressures up to 150 psi and will absorb line expansions of 1½ in. The specifications for the 1-in. model are: Pipe size, 1 in.; overall length, 9⅝ in.; maximum OD, 2⅜ in.; working pressure, 150 psi; weight 2.8 lb.

Male NPT nipples are standard, with ground joint unions or weld end also available.

More information? Circle Item 11 on postcard, page 153.

Portable System Collects Dust

A portable, packaged dust collecting system, called Dust-Pak, is announced by Schmieg Industries, Inc., Detroit, Mich.

The unit is made for use in small installations or on isolated machines in large plants. It is available with casters where flexibility is desired for special operations.

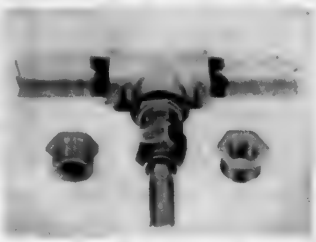
The collecting system extracts dust and other particles from the air by a combination of centrifugal separation and filtration. It has a replaceable, standard, throw-away type filter. The manufacturer points out that the centrifugal action minimizes the dust load transmitted to the filter, thereby adding to its length of service.

Heavier particles are separated from the air and deposited in a drawer at the base of the unit for disposal. The system is available in sizes from 400 to 100 cfm.

More information? Circle Item 12 on postcard, page 153.

Bushing Prevents Freezing

A dielectric bushing for the control of electrolysis in plumbing, heating, and gas applications has been developed by May Co., Galesburg, Ill.



Made from Nylon, the dielectric bushing withstands temperatures up to 300 deg F. It is made from the same material used for aircraft tow ropes, gears, bearings and other industrial jobs. Although it will withstand stress, the bushing is so designed that it is encased in metal which supports it against stress when the joint is complete.

No pipe dope is necessary with the bushing, but it can be used without adverse effect on the Nylon. No pipe wrench need be applied to the bushing due to the tapered thread design which makes it possible to tighten the joint by applying the wrench to the two metal fittings.

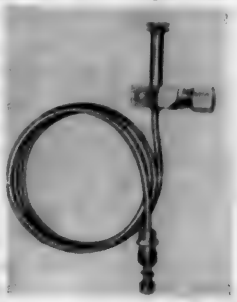
The bushing can be loosened without difficulty and does not freeze in the fitting. It should be used wherever dissimilar metals such as copper and galvanized metals are joined.

Bright red in color, the bushing is packed in cellophane, with a label and directions.

More information? Circle Item 13 on postcard, page 153.

Pilot Burner Made Larger

A miniature combination pilot burner and themocouple, called the Mini-Pilot, is being produced in a larger size for use on water heaters, heating equipment, clothes dryers, and other larger appliances by Robertshaw-Fulton Controls Co., Grayson Controls Div., Long Beach, Calif.



The larger unit has a nominal input of 200 Btu per hr compared with a 100 Btu per hr rating for the original pilot.

Like the original, the new pilot burner is non-aerated in its operation to eliminate linting and clogging, one of the chief causes for service calls and customer complaints regarding pilot burners. It contains a built-in, thermocouple, safety shutoff, capable of generating a high voltage. This feature allows for flexibility in the choice of high limit switches and leads in water heater installations.

The new pilot burner is suitable for all gases and is available with the gas inlet on either the side (illustrated) or bottom.

More information? Circle Item 14 on postcard, page 153.

Electric Baseboard Heater

An electric baseboard heater is available from Westinghouse Electric Corp., Pittsburgh, Pa. The units are installed along the wall in place of baseboards and provide heat by both radiation and convection.

The baseboard heaters can be operated with furniture placed flush to them or with draperies hung above and against them. The maximum temperature of the vertical outer surface is approximately 100 deg F, or just above normal body temperature.

Installed in 2-ft sections, as many units are used in each room as engineering specifications require. A control panel is coupled into the heating system of each room, allowing room-by-room use and conservation of heat. There are no moving parts in the heaters.

The only power requirement is a source of 240v a-c, which is the same voltage required for the conventional electric range and water heater.

The heaters are finished with a neutral-beige enamel that requires no additional finish but can be painted any desired color. Although designed primarily for surface mounting, the units can be recessed to mount against studding.

The units are rated at 250 watts per ft. They are 7 in. high and 2⅝ in. wide.

More information? Circle Item 15 on postcard, page 153.

Round Commercial Thermostat

A pneumatic thermostat that has a spherical shape and operates on force balance or continuous feedback principles is announced by Minneapolis-Honeywell Regulator Co., Minneapolis Minn.

Called the Pneumatic Round, the improved control is the company's first round design in the commercial temperature control field. The design has become standard in the company's residential heating and air conditioning controls. It will be available at the same price as the company's previous air-activated thermostats.

The force balance principle provides a specific air pressure signal for a given temperature deviation, which is detected by the thermostat's bi-metal sensing element. By continuously balancing the air supply against the requirements, it is possible to attain a modulation of valves or motors controlled by the thermostat. This virtually eliminates over and undershooting or hunting.

Designated the TO-910, the control also has a larger bi-metal sensing element with a faster response to temperature changes, in order to reduce the lag in heating or air conditioning system response time.

Following the style trend set in the residential heating and cooling control field, the instrument's cover is a half-sphere. This can be removed and painted or papered to harmonize with the interior color scheme of the room. The steel cover can, however, be locked to the base by adjusting two screws. This makes it suitable for use in areas where it may be subject to shock or tampering.

A single, direct-action dial provides for thermostat setting and temperature indication. A scale in the center of the cover serves both the thermometer and thermostat-setting pointers. Adjustable stops inside the instrument make it possible to limit the temperature adjustment range or to lock the control at a single point for installations where excessive adjustment is not desired.

Other engineering advances include: the use of flexible plastic tubing; calibration which requires the use of a screwdriver only; adjustable throttling ranges; fewer moving parts than previous types; designed for both flush and surface mounting; and a replaceable filter.

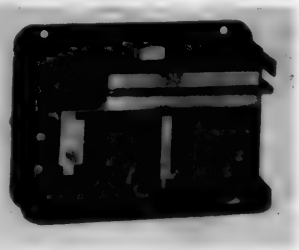
For modernization, it can be supplied with a round adaptor plate to cover marks left on walls by previous thermostats.

More information? Circle Item 16 on postcard, page 153.

Low-Draft Cutoff Switch

A program-control switch for automatic fuel-burning systems with motorized draft inducers is made by Cleveland Fuel Equipment Co., Cleveland, Ohio, to provide a timed, pre-purge period and protection against draft failure, without nuisance shutdowns due to momentary puffs during startup, or other transient conditions.

Named Model LD2T-A Lo-Draft, the cutoff switch is designed to add protection from draft failure hazards to boiler-burner installations, without making complicated changes in the original wiring scheme of the burner and control circuit. The model can also be used when pre-purge is already provided by existing burner controls.



The switch is energized at the same time as the fan starter. After 20 sec of purge timing, current flows to a draft safety switch. This switch, operated by a sensing mechanism connected to a sample of the breech draft, passes current to a time-delay tube if draft conditions are safe. After 10 sec, the tube passes current to the burner starting device.

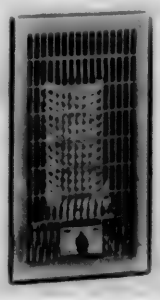
If draft is not sufficient, the burner cannot start and an indicator lamp lights. If draft fails, an 8 sec time delay begins. If draft is not restored in this time, the burner is shut down. But momentary puffs will not cause the burner to shut down or recycle.

An adjusting knob is provided to permit the selection of the low-draft cutoff point over a complete range. The switch will operate on 115-v or 230-v a-c. Terminals are provided for remote signal or alarm. The switch is fail-safe, and the failure of any component will shut down the burner.

More information? Circle Item 17 on postcard, page 153.

Heater Has Time Control

An electric bathroom heater, the 15-TH, with a built-in mechanical time-switch control to prevent wasted power, has been designed by Wesix Electric Heater Co., San Francisco, Calif., for bathrooms in the home, in apartments, offices or motels, or in other places where heat may be wanted for short periods only.



The timer may be set for periods up to one hour. Setting it assures that the heater will automatically turn off after the set time elapses and thereby guard against wasting power through carelessness or oversight.

The unit heats by radiation and convection and utilizes an electric chimney similar to those in the company's major heaters to provide steady, even warmth as well as instant radiant heat. It has a chromium finish and can be installed between studs.

The heater is listed and approved by Underwriter's Laboratories, Inc.

More information? Circle Item 18 on postcard, page 153.

Grille Matches Diffusers

An extended, baseboard, return air grille, the Series 77, is being manufactured in both a 4-ft size with 53.2 sq in. of free area and a 2-ft size with 26.6 sq. in. of free area by Lima Register Co., Lima, Ohio.

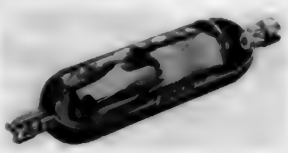
The grille is a matching companion piece to the Series 70 perimeter extended baseboard diffuser, with an automatic pushbutton damper control, and the Series 75 baseboard diffuser, without a damper for economy installations.

The return air grille has the same medium beige finish, horizontal louver design, and installation features as the two baseboard diffusers. It also has the same dimensions and is available in 2- and 4-ft sizes. It may be assembled in any multiples for continuous installations by using the company's joining connector.

More information? Circle Item 19 on postcard, page 153.

UL Approves Filter-Driers

Refrigerant filters and driers called Super-Flo and Cross-Flo and manufactured by Remco, Inc., Zelienople, Pa., have been approved for use with Freon-12 and Freon-22 by Underwriters Laboratories. The minimum bursting pressure required for use with Freon-22 is 1500 psi and for Freon-12 it is 1175 psi.



On some applications of air - cooled units using Freon-22 operating head pressures have been found to run higher than normal, and Underwriters Laboratories may require that the ultimate bursting pressure on the high side be a minimum of 2000 psi. Manufacturers who require the higher bursting pressure should so specify, and the filter-driers can be supplied to meet their requirements.

The Super-Flo model has a Fiberglas depth filter, a molded drying element, and a spun-end copper shell. The Fiberglas bag removes foreign matter from the refrigerant stream. For safety, a 30 x 150 mesh Dutch weave outlet filter stops particles larger than 0.0046 in.

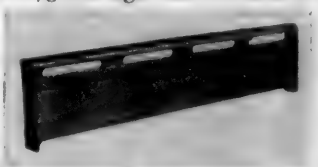
A molded drying unit, called Remcal, removes moisture both chemically and physically, absorbing acids to a level below danger from corrosion. Chemically absorbed moisture is retained in the drying element though temperatures rise to 200 deg F. Because of the chemical bond, the molded drying unit is effective in hot liquid lines, with either Freon-12 or Freon-22.

More information? Circle Item 20 on postcard, page 153.

Baseboard Offered in 2 Sizes

Radiant, cast iron baseboard called Base-Ray is offered in two sizes by Burnham Corp., Boiler Div., Irvington, N. Y.

The larger size, No. 9, is 9⅞ in. high and is rated at 3.45 sq ft per lin ft by IBR standards The other size, No. 7, is 7 in. high, and it is rated at 2.35 sq ft per lin ft also by IBR standards.



The larger size is intended for installations where heat losses are great or wall space is at a premium. The smaller size is for use in normal installations. Both sizes have the company's same streamlined design.

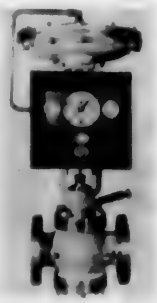
An installation guide for the baseboards is available.

More information? Circle Item 21 on postcard, page 153.

Pressure and Temperature Pilot

A double-acting pilot for use with control valves is being manufactured by A. W. Cash Co., Decatur, Ill.

Known as the Standard Type 51, the pilot permits the regulation of temperature as well as pressure. It is applicable for pressure ranges from 0-15 to 0-10,000 psi, and vacuums of 0-30 in. of water and 0-30 in. of mercury. Pressure-sensing elements are available in phosphor bronze, beryllium copper, or stainless steel.



Temperature ranges are from —40 to 1000 deg F, with a mercury-actuated, armored capillary, temperature-sensing element that is available with a plain bulb, a union connection, or a union connection with a separable socket.

Other features of the pilot are: a process pressure or temperature gage in the pilot; a calibrated set point adjustment; feedback proportional control, with 1 to 100% proportional band and differential gap; availability with proportional and automatic reset action; and a metal power relay which has a sapphire jewel nozzle feed orifice with a pushbutton cleaner.

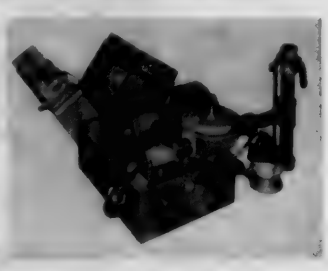
The pilot can be ordered separately or mounted on the company's control valve as illustrated.

More information? Circle Item 22 on postcard, page 153.

Burner Is Adjustable

A new model forced combustion, gas conversion burner, known as the Heatwell Adjusto V, has been designed for large commercial and industrial installations by Hastings Air Control, Inc., Omaha, Neb.

Sixteen different size units are made with capacities ranging from 350,000 to 4,400,000 Btu per hr, input.



The conversion burner features an adjustable flame angle to conform with individual boiler requirements and a design that has been improved to provide faster heat transfer. Refractory brick is included as a part of the burner head assembly in order to eliminate the need for building combustion chambers.

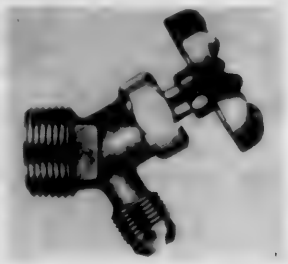
Other features of the burner are a controlled air and gas mixture to give uniform combusiton under different draft conditions and, for safe operation, a positive gas purge after each burner cycle.

The burner is delivered factory-assembled, wired, and tested.

More information? Circle Item 23 on postcard, page 153.

Fuel Oil Shutoff Valve

A packed-type, shutoff valve, named the Kantleak 20V Series, has been designed for fuel oil tank and oil drum installations by Anderson Brass Co., Detroit, Mich.



The large pipe thread end allows the valve to be fastened directly to a tank or drum without the use of adapters. Its angle body design eliminates the need for sharp tubing bends. An alloy stem and wheel handle help to provide more accurate seating.

The series of valves includes the following four types and sizes: 23V-6P ⅜-in. compression x ½-in. male pipe thread; 23V-6R ⅜-in. compression x ¾-in. male pipe thread; 25V-6P ⅜-in. flare x ½-in. male pipe thread; and 25V-6R ⅜-in. flare x ¾-in. male pipe thread.

More information? Circle Item 24 on postcard, page 153.

Plastic Pipe Fittings

Metal fittings for flexible plastic pipe are available from Campbell Mfg. Co., Inc., Boyertown, Pa.

Made of steel, the fittings are produced from galvanized pipe, machined, and electroplated. The same items are also available in 85/15 red brass pipe.

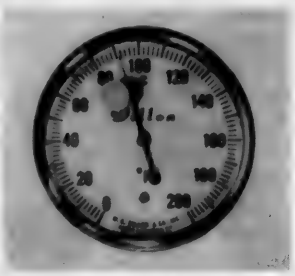
Included in both lines are male and female adapters, couplings, ells, and tees in sizes ½, ¾, 1, 1¼, 1½, and 2 in. Well seal ells, and Venturi male and female adapters are available in 6, 8, 10, and 12-in. lengths.

More information? Circle Item 25 on postcard, page 153.

Thermometer Has Signal

A bi-metallic thermometer, called Signal Eye, with a visual warning signal that can tell an operator when normal temperature readings rise or fall is manufactured by W. C. Dillon & Co., Van Nuys, Calif.

The signal is effected by a bright red disc attached to the pointer. An opaque disc of the same diameter is attached to the dial glass over the spot where it coincides with the red disc. Temperature variations cause the pointer to fluctuate above or below the opaque circle, revealing the red signal eye to the observer. Steps may then be taken to stabilize the temperature of the test setup.



Applications for the thermometer are usually found in places where height or distance make it impractical to read the actual temperature and where it is important only to know that it is off from normal. The opaque disc can be re-positioned by the operator should a new standard operating temperature be selected.

The thermometers are available in 3- or 5-in. diameter dial sizes and in stem lengths from 2½ to 72 in. Fahrenheit ranges vary from −40 to +160 deg, with intermediate ranges and a high of 200 to 1000 deg. Centigrade ranges run from −10 to +110 deg and up to 0 to 300 deg. All are individually calibrated to an accuracy of 1% of the full scale reading.

More information? Circle Item 26 on postcard, page 153.

Room Cooler In Console Cabinet

A self-contained air conditioning unit is being produced by York Corp., York, Pa., to make available year-round air conditioning of individual spaces to suit tenant requirements.

Housed in a console cabinet, the air conditioner eliminates the cluttering-up of window sills and the interference with window-washing.

Designated as Yorkaire CSA, the unit is designed to replace the radiator and to utilize the conventional steam or hot water heating pipes which are connected directly into the air conditioner.

An outside air intake is installed flush with the outside wall for condenser cooling and to provide fresh air, which is prefiltered before entering the room, thus minimizing cleaning and redecorating costs. Designed for hotels, apartments and office buildings, the units can be installed in one or two rooms at a time while redecorating with a minimum loss of occupancy or revenue.

More information? Circle Item 27 on postcard, page 153.

(*Continued on page* 142)

ANOTHER CASE OF **COPPER** WHERE IT COUNTS

350-HOUSE BRISTOL PARK TRACT, Santa Ana, California

"Foot for foot, pound for pound, nothing installs as economically as COPPER WATER TUBE,"

Says GARY STICE
Earl O. Stice Co., Mechanical Contractors, Glendale, Calif.

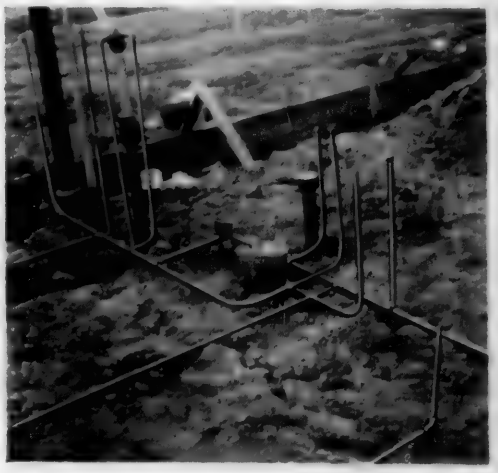
Said Mr. Stice, "Whether or not codes call for copper when imbedding plumbing and heating lines or radiant panel heating coils in a concrete slab I play it safe and use copper anyhow. For with non-rusting copper, moisture and seepage are never a problem.

"And, as far as installation is concerned, fewer joints are necessary with copper water tube. Then, too, you can always be sure that the few solder joints that you do make are tight . . . a mighty important item when you're imbedding in concrete. So with all these advantages of copper water tube you can see why I have found it the most economical material to install."

You will find Revere Copper Water Tube installs economically when used for plumbing lines, radiant panel heating, air conditioning, underground service lines, waste, stack and vent lines, processing lines.

And if you want to know the short cuts, or have installation problems, involving Revere Copper Water Tube, let us know and we'll put you in touch with our Technical Advisory Service.

ONE OF THE HUNDRED completed homes shown in the large aerial view above. There will eventually be 350 homes in this tract. 34,000 feet of enduring Revere Copper Water Tube have already been installed in the first hundred homes in ½", ¾" and 1" sizes. Bldr. and Gen. Cont.: M. J. BROCK & SONS, INC., Los Angeles, Calif. Revere Dist.: KEENAN PIPE & SUPPLY COMPANY, Los Angeles, Calif.



NON-RUSTING REVERE COPPER WATER TUBE before imbedding in the concrete slab.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

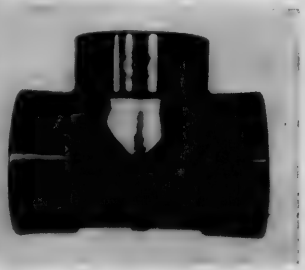
• • •

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

(*Continued from page* 140)

Two Fittings Added to Line

A short-radius, 90-deg bend and a short-pattern tee (illustrated) are added to the pipe fitting line of Line Material Co., Milwaukee, Wis.



The new fittings are designed for use with 4-in. L-M Perma-Line pipe and supplement the short-radius, 45-deg bend announced previously. They are made of a lightweight composition material that is compatible with bituminized fiber pipe.

Both the pipe and fittings resist absorption of water and chemicals, such as organic acids, alkalis, inorganic materials, and wastes. The flow capacity through the fittings is increased by their smooth inner surface.

More information? Circle Item 28 on postcard, page 153.

Outdoor Heating Thermostat

An automatic outdoor thermostat control has been developed by General Electric Co., Schenectady, N. Y.

In operation, the outdoor control tips off the indoor thermostat to changing weather conditions. This helps prevent indoor temperatures from dipping with sudden outside changes.

Ordinarily a drop in outside temperature means that the homeowner is required to adjust his indoor thermostat upward to compensate for heat loss through the colder walls. The new system does this automatically, eliminating manual adjustment on the part of the homeowner.

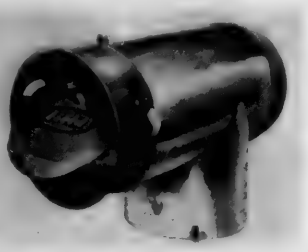
The heart of the outdoor thermostat is a small wafer of a peculiar carbon compound that senses weather changes and then sends a minute electrical signal to the indoor thermostat. Thus warned, the indoor thermostat turns on the furnace to cope with lower temperatures.

More information? Circle Item 29 on postcard, page 153.

Conversion Draft Control

A draft control, the Type "G", has been developed by Field Control Div., Mendota, Ill., to meet the special problems of gas conversion burner installations. It is available in a 7-in. size, for 6, 7, and 8-in. flues.

Two of the problems, faced in a gas conversion job, which the control is designed to meet are: often times limited headroom or obstructions make the proper installation of a draft hood impossible, and, because of long or perhaps small diameter flue passages, the equipment may require more draft than is possible to obtain with a draft hood.



The double-acting control opens inward only when there is an excess of draft so that, when needed, all the draft a chimney is capable of producing is made available to the heating plant. There is no excess of draft because the control opens and offsets any draft beyond the minimum needed.

Because the control is double-acting, the gate also opens outward at the slightest pressure, to provide relief in case of a blocked flue or down draft. It has stainless steel knife edge bearings to assure sensitivity for the gate, without danger of corrosion or fouling.

Literature covering the proper installation of the control in conversion work is available on request.

More information? Circle Item 30 on postcard, page 153.

Impact Chuck for Drills

An attachment that converts almost any type of electric drill into an impact wrench is called Stutter-Chuck and is manufactured by Hewitt & Co., Los Angeles, Calif.

Operationally, the instrument chucks up into a portable electric drill, or drill press, and serves as a fastening tool. It tightens bolts and nuts, wood screws, lag screws, sheet metal screws, and other fasteners that are tightened by rotary impact.

Cylindrical in shape, the attachment weighs 2 lb and is 3¾ in. long by 2-5/16 in. in diameter.

Four models are available with socket drive sizes ranging from ⅜ to ½ inches square with input shaft sizes from ¼ to 5/16 in. One model will deliver four blows per revolution; the other three models will give two blows per revolution. Depending upon the type of portable electric drill (heavy, medium, or light-duty), the range of speeds of the four models is from 750 to 2400 rpm.

The components of the attachment including the hammer, anvil, and shank, are heat treated. The housing is made of aluminum. When not in use, the attachment fits into a toolbox or crib.

A reversing switch, which can be installed on most portable drills, allows the attachment to perform loosening operations.

More information? Circle Item 31 on postcard, page 153.

Monobloc Rotary Pumps

The GA rotary pump line is available as a monobloc from Worthington Corp., Standard Pump Div., Harrison, N. J.

The new design permits twenty-eight possible piping arrangements by means of two suction and two discharge outlets and reflects many of the advantages and features that the monobloc aspects of the centrifugal pump provide.

Unlike the monobloc centrifugal, the motor in the new design is connected to the rotary pump with a coupling, enabling pump replacement and eliminating shaft alignment problems.

The line of rotary pumps is rated in capacities up to 25 gpm and pressures to 150 psi.

More information? Circle Item 32 on postcard, page 153.

(*Continued on page* 144)

...and what keeps a building young?

What is it that keeps some buildings "young" . . . always with a waiting list and never a vacancy . . . while other structures half their age are regarded as old? You generally find the answer in a *management* that maintains the building properly . . . and behind that, an *architect* who appreciated the importance of designing for "perpetual youth."

Because the rest room is one place where a building is most likely to show its age, smart architects today plan this area with particular care. They specify off-the-floor plumbing fixtures in all major new buildings. These not only *look* modern . . . they make it easy to maintain hospital-like standards of cleanliness and sanitation. They facilitate redecoration, and give the widest latitude in future desired changes in the structure of floor or wall.

You will find also, in most such installations, that the fixtures are suspended on the ZURN SYSTEM®. The patented, engineered features of the ZURN SYSTEM makes installation easy, alignment simple, and support completely and permanently dependable. All of the stress is carried by the system . . . no stresses are transmitted to the wall. The best indication of how successfully the ZURN SYSTEM does its job is shown by the 800,000 individual fixtures currently supported on the ZURN SYSTEMS.

To help sell your clients on this modern mode in rest room design, write for our free booklet, "Behind Closed Doors." 110-3

J.A. ZURN MFG. CO.

PLUMBING DIVISION

ERIE, PA., U.S.A.

The Zurn Zero Zone® is created by mounting off-the-floor plumbing fixtures on behind-the-wall ZURN SYSTEMS. This permits the highest degree of rest room sanitation to be attained and maintained. All major plumbing manufacturers make fixtures to fit this system.

See our catalog in Sweet's Architectural File and Industrial Construction File.

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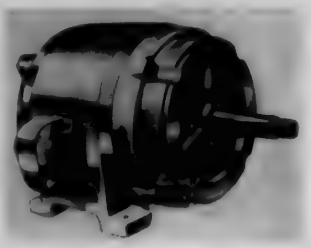
(*Continued from page* 142)

Close-Coupled Pump Motor

A motor with a face-type, registered bracket, suitable for close-coupled centrifugal pump applications, has been developed by U. S. Electrical Motors, Inc., Los Angeles, Calif. Built to the new, rerated NEMA specifications, the Uniclosed motor is more compact.



A pump may be mounted flush with the motor by bolting it to the face bracket. This method of coupling insures alignment of the pump and motor. To prevent water from entering the motor, a solid flange and brass slinger are used.

The shaft has a shoulder and tapped hole for mounting the impeller. Its diameters are ground to close tolerances to prevent leakage. The motors are available in ratings from 1 to 30 hp.

For additional protection against water entering the motor, Ventrifoil deflectors are used to direct air and deflect water. The motor's split-type conduit box can be rotated in 90 deg steps and located on either side of the motor.

More information? Circle Item 33 on postcard, page 153.

Device Absorbs Pump Pulses

Vibration and pounding encountered in both suction and discharge lines in pump installations can be reduced as much as 75% with the pulsation absorber developed by Tri-Rotor Pump Dept., The Yale & Towne Mfg. Co., Stamford, Conn.

The pulsation absorber dampens recurrent, momentary shock pressures without reducing operating capacities, nor does the absorber affect the variable control feature of the company's pumps.

Originally developed to dampen vibration in jet fuel testing installations, the pulsation absorber expands the practical application for the company's pumps, especially in pumping systems where changes in flow rate together with natural vibrating frequencies have caused difficult problems.

The pulsation absorber is a piston device which equalizes pulse peaks in either the discharge or suction sides of the pumps and makes auxiliary dampeners or air chambers unnecessary.

Constructed as a part of the shaft housing, the absorber is installed on existing pumping equipment by a change in housings. In making this change, no piping need be disturbed.

The pulsation absorber consists of a cylinder connected across the suction and discharge ports of the pump. Within this cylinder is a light plunger which operates against a heavy spring in the suction side of the cylinder and a light spring in the discharge side.

When a pressure leak is produced at the discharge port by a pump impulse, the piston moves toward the suction side. This action relieves the pressure peak and, at the same time, compensates for the corresponding suction increase which is developed at the pump intake.

More information? Circle Item 34 on postcard, page 153.

Heaters Can Be Suspended

Three new models are added to the line of industrial heating equipment made by Armstrong Furnace Co., Columbus, Ohio.

Suitable for installation in churches, schools, stores, restaurants, service stations, garages, and similar buildings, the new models are oil-fired, suspended heaters in the 8801-L8 series. They are rated at 225,000, 275,000 and 350,000 Btu per hr.

Called Space Savers because they can be suspended in an otherwise unused area, the heaters measure 29 inches in height and 65½ inches in length. The L8-350 is 63 inches deep, while the L8-225 and 275 are 44 inches deep.

After installing the burner, suspending the unit, and connecting the power and fuel lines, the unit is ready to produce heat. The entire unit is shipped complete from the factory.

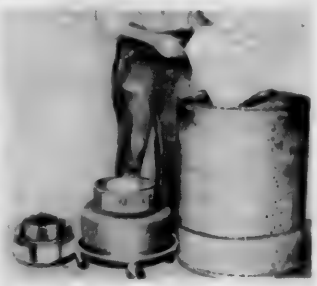
The combustion chamber and secondary heat exchanger tubes, are built in a tear drop design. This design permits the blower air to be passed over the entire surface of the tubes and chamber to provide maximum heat transfer into the air stream.

More information? Circle Item 35 on postcard, page 153.

Furnace Cleaner

A furnace cleaner with a white fiber disposal bag for soot is available from Thompson & Sons, Inc., Lyons, Ill.

When a furnace cleaning job is finished, the disposal bag is disconnected and the opening sealed with a sticker; it is discarded with the soot. The bag will hold up to 12 lb of soot.



The furnace cleaner is sold as a unit with the disposal bag, 10 ft of rubber hose with a swivel at each end, a crevice tool, a round duster brush, a 2-ft metal wand, and 24 secondary filters. Its overall height is 24½ in., and its overall diameter is 18 in.

The unit is powered by a 115-v, universal motor and is equipped with three 3-in., ball bearing casters and a rubber bumper.

More information? Circle Item 36 on postcard, page 153.

(*Continued on page* 146)

THE ONLY Matched

COOLING TOWERS and CONDENSERS

The Halstead & Mitchell Cooling Towers you select are *matched* by design to work with the famous Halstead & Mitchell water-cooled Condensers. You need no longer buy a high-efficiency cooling tower to work with a low-efficiency condenser (or *vice-versa*) . . . a long-life cooling tower to work with a short-life condenser (or *vice-versa*).

Remember that every cooling tower you sell is planned to work with a water-cooled condenser—then you'll see why America's leading manufacturers of air-conditioning and refrigeration equipment have swung to Halstead & Mitchell for their original equipment needs in both these components.

With cleanability you'll sell more. Why sell less?

20-Year Guarantee!

on the wetted deck surface against rotting or fungus attack

Only Halstead & Mitchell pressure-creosoting can provide a *guarantee* against immediate attack by fungus and marine parasites . . . or chemical deterioration from acids in water.

Added to this H&M exclusive are other major advantages. There's ultra-high efficiency in the gravity-type water distributing pan which eliminates extra pumping head required on spray type towers . . . and cuts down on water losses due to "atomizing" of water. And there's extra-long life in stainless steel fans . . . and sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber.

2 thru 120 TONS

½ thru 25 TONS

Lifetime Cleanability

The *mechanical* cleaning of H&M double-tube, counter-flow condensers means the simplest, least dangerous method of restoring new unit efficiency. Whether removing a heavy coating of sludge and scale, or a thin insulating film on the inner walls of the copper tubing, the mechanical cleaning tool restores heat transfer efficiency in a matter of minutes. The result is lowered discharge pressures . . . more heat carried off by cooling water . . . lower bills. *Only* the impurities are removed . . . the thickness of the copper wall remains intact, and the condenser gives extra years of peak service.

At Leading Heating and Refrigeration Wholesalers

EVERYWHERE

Write for Detailed Specifications

Halstead & Mitchell

BESSEMER BUILDING • PITTSBURGH 22, PA.

(*Continued from page* 144)

Push-Button Wall Switch

A push-button wall switch has been developed for household lighting circuits by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Called the Tap-Lite, the switch consists of a slender, concave, flush-mounted wall plate and a single, gold button actuator. A light tap of the buttom makes or breaks contact.

First deliveries of the new control are scheduled for late summer with distribution to be handled through regular electrical channels. All models are approved by Universal Laboratories and are priced according to type of switch and number of plate gangs.

The washable Plexiglas switch plate can be made to match the interior color scheme of a room through the use of color inserts mounted behind the transparent plate. The inserts are available in four basic colors, can be painted to match other wall shades, or used as patterns from which matching wallpaper inserts may be made.

The control combines the features of low-voltage switches with those of conventional line-voltage switches. The use of screwless terminals assures electrical contact and makes it possible to connect the switch to the household wiring with a minimum of time and effort. The Plexiglas plate is installed on a spring-loaded clip and can be snapped off the wall for cleaning or redecorating.

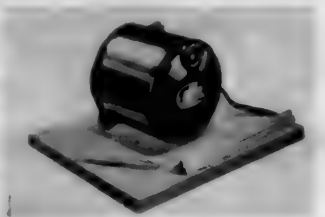
Switching action is effected by a Micro switch of the type used in industrial and aeronautical switching operations. The switching mechanism is sealed from dirt and dust, is shock-proof, and can be mounted in any desired position.

More information? Circle Item 37 on postcard, page 153.

Oil Burner Motors

A line of lightweight motors for oil burners is announced by The Ohio Electric Mfg. Co., Cleveland, Ohio.

Approved by Underwriters Laboratories, Inc., and built to NEMA specifications for oil burner motors with No. 56 frames, the new units are designated as Series 991 motors.



Currently in production, they are available in 1/6, ⅛, 1/10, and 1/12-hp sizes, either for 115 or 230-v, 50 cycle (1450 rpm) or 60-cycle (1725 rpm operation.

Not a modification or adaptation of earlier models, the motors have an average weight of 15½ lb. The ⅛-hp motor has a breakdown torque of 21½ oz-ft and a locked-rotor torque of 15 oz-ft; other sizes have comparable performance characteristics.

The motors are based on a three-piece construction design and are completely enclosed. The end-bells are made of die-cast, aluminum alloy, each with 12 strengthening ribs. The stator ring is fabricated from a single piece of 12-gage steel, and the stator coils are insulated with class A insulation. The rotor core is an aluminum alloy die casting.

The starting switch, called Synchro-Snap, has one moving part and is rated at 1 million cycles.

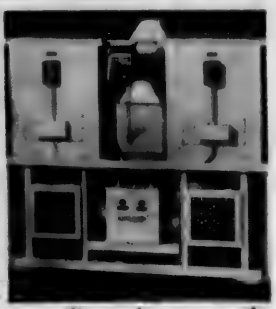
The oil burner motors are supplied with rubber covered leads as standard, with cord or cord sets, or with special lead outlets. They are finished with flat black paint.

More information? Circle Item 38 on postcard, page 153.

Industrial Dehumidifier

An adsorption type, heavy duty dehumidifier, for use in factories, warehouses, storage vaults, and other large areas where controlled humidity is desired, has been developed by Dryomatic Corp., Alexandria, Va.

Designated T-150, the dehumidifier is an automatically regulated dual-tower unit, using silica gel as the drying agent. It is designed to maintain humidities as low as 10% in areas up to 60,000 cu ft over a range of temperatures. The machine has a dry air output of 150 cfm and is capable of removing 4 to 5 lb of water per hr. The regeneration of the silica gel is accomplished automatically by electric heating elements.



The machine has a motor-operated, 4-way valve which alternately directs the air from one silica gel tower to the other. As one tower is regenerated the other continues to dehumidify, thus providing a constant flow of dry air. Thermostats control the regeneration cycle, thus making the machine self-adjusting to atmospheric conditions.

The unit requires standard electrical outlets and duct work. It can be mounted on casters for relocation. Built-in or remote humidistat control can be provided for completely automatic on-off operation.

Suggested applications for the machine are in candy plants, refrigerated warehouses, dairies, fur and garment storage, electronic instrument areas, chemical laboratories, seed storage, and for rapid drying of plaster in the building industry. It may also be used with air cooling equipment for low temperature, low humidity installations. The unit measures 51 x 28 x 44 in.

More information? Circle Item 39 on postcard, page 153.

Manufacturers' Representative

If you are seeking new lines, we suggest you register your name, territory covered, and present lines with this publication. We get numerous requests from manufacturers seeking representatives and by registering you pave the way to lining up desirable accounts. Write to the Editor, AIR CONDITIONING, HEATING AND VENTILATING, 93 Worth St., New York 13, N. Y.

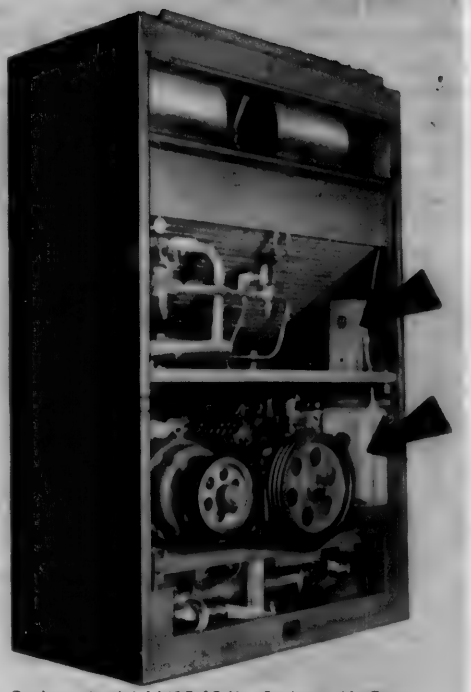
(*Continued on page* 148)

Typhoon Model 214SC 20 Hp, Package Air Conditioner which is equipped with Allen-Bradley Bulletin 709 motor starter and controls.

Bulletin 836
Pressure Switch

Bulletin 837
Temp. Control

Special Control
Panel



Typhoon Model 164SC 15 Hp, Package Air Conditioner which is equipped with Allen-Bradley Bulletin 709 solenoid starters.

TYPHOON AIR CONDITIONERS
use Allen-Bradley Trouble Free Motor Controls

Allen-Bradley Bulletin 709 solenoid starters are available in 8 sizes up to 300 hp, 220 volts; 600 hp, 440-550 volts.

Manufacturers—and especially ultimate users—cannot tolerate trouble in their air-conditioning and refrigeration controls. Actual experience under all operating conditions has proved Allen-Bradley controls are good for millions of trouble free operations. That's the kind of reliability that has established the world-wide Allen-Bradley reputation for QUALITY.

Allen-Bradley reliability is due to the SIMPLICITY of design, QUALITY of workmanship and materials, and THINKING in terms of the user of the apparatus.

When you obtain the combination of these three factors in motor controls, you don't have to worry. QUALITY performance is assured. Specify Allen-Bradley.

Allen-Bradley Co.
1330 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

The Sign of QUALITY Motor Control

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

QUALITY

(*Continued from page* 146)

Hot Water Boiler

An oil-fired steel boiler, the Winkler, with six heating surfaces is being marketed by franchised dealers of U. S. Machine Div., Stewart-Warner Corp., Lebanon, Ind. Having a maximum gross SBI output of 115,000 Btu per hr, the unit comes equipped with a tankless hot water heater.

The water content of the boiler provides a constant amount of hot water for automatic washers and dishwashers.

Two sets of double economizers provide four extra heating surfaces in the boiler. Stack temperatures of the boiler are low, and the draft loss or resistance through the boiler is sufficiently low that it does not need a chimney.

The specifications of the unit exceed requirements of the ASME. The thinnest pressure part is ¼-in. thick ASME boiler plate, and the head sheet, crown sheet, and mud rings are made from ½-in. thick boiler plate. There are no tubes in the boiler.

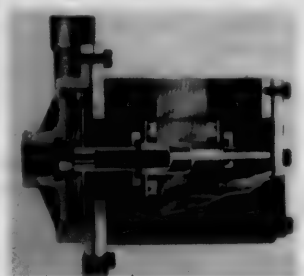
Six adjusting screws in the boiler enable a mechanic to install the burner in alignment with the refractory combustion chamber. There is sufficient room to seal between the refractory and gun tube.

The boiler is a packaged unit with hot water specialties, a tankless water heater, and a thermal valve which prevents the boiler water from leaving the unit when its temperature drops below 180 deg F. The boiler illustrated is fired with a low pressure burner; high pressure burners may also be used.

More information? Circle Item 40 on postcard, page 153.

Pumps Have Cooling Circuit

New methods of construction, new materials, and a new cooling circuit are offered in the Model S series centrifugal pumps made by Chempump Corp., Philadelphia, Pa. In addition, the new ⅛ to 3-hp units are priced lower than their older but still available counterparts, the Model C series.



The new series of pumps have fabricated parts which can be clad with such metals as titanium, zirconium, and Hastelloy series metals, as well as Monel, Carpenter 20 and the various types of stainless steels previously available. Corrosion resistant service on a wider scale is therefore possible with the series.

Approximately four hundred percent more bearing area is offered by the bearings developed for the new series. Made of Graphitar, the bearings are semi-floating and can be replaced from the front or rear of the pump without the necessity of using special tools and without breaking piping connections.

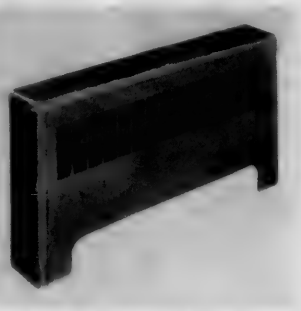
Cooling for the stator windings, rotor, and bearings, as well as bearing lubrication, is provided by a cooling and fluid circulation system. Pumped fluid passes from the pump chamber, through the front bearing, into the rotor chamber, and through the rear bearing, returning to the eye of the impeller through the hollow rotor shaft. No external cooling circulation tube is used.

The pumps are made with capacities to 170 gpm and heads to 150 ft. Standard temperature and pressure limits are 350 deg F and 150 psi.

More information? Circle Item 41 on postcard, page 153.

Line of Convectors

A line of convectors, including free-standing, wall-hung, and recessed models, is introduced by Spartan Convector Co., division of Spartan Shower Stall Co., Brooklyn, N. Y.



The convectors have low-resistance, steam and hot water headers. The complete line features dampers in a range of popular sizes; their widths are 4, 6, and 8 in. All units are tested in accordance with Commercial Standard CS-140-47, established by the U. S. Dept. of Commerce.

An 8-page, illustrated folder containing complete technical data on the convectors is available.

More information? Circle Item 42 on postcard, page 153.

House-Connection Pipe

Factory-made, mechanical joint pipe called Speed-Seal is being produced in the West by Pipe Products Div., Gladding, McBean & Co., Los Angeles, Calif. The pipe is recognizable from its yellow pallets, labels, and spigots, the latter made of polyester plastic.

Approved for use in Western communities, the pipe can be installed in a 50-ft. line in 8 to 10 min by a two-man crew without special tools or skills. With the pipe on pallets, or standing by the trench, natural rubber rings are placed on the spigots. The inside surface of the bells and gaskets are brush-coated with lubricant. The spigot of each new section is put into the bell ahead and shoved into place. There is no need to wait for the joints to set.

The pipe is delivered to jobsites in no-deposit, throwaway pallets containing pipe for four average jobs. This includes thirty 4-ft. sections, 30 gaskets and a field instruction manual.

More information? Circle Item 43 on postcard, page 153.

(*Continued on page* 150)

BARBER COLMAN

uni-flo Engineered Air Distribution

High velocity air distribution one of advanced features in Manhattan "glass-box" bank

Photos by Ezra Stoller

"A showcase for banking" is a vivid picture phrase describing this unusual new Fifth Avenue Office of Manufacturers Trust Company in New York City. Skilled professional craftsmanship has created a structure unlike any other financial institution in the world. In its creation, the designers have employed most recent developments in structural and operational techniques. Among them is the space-saving high velocity air distribution system, using the Uni-Flo High Velocity Air Valves to supply conditioned air quietly, effectively for comfort of patrons and employees.

Architects: SKIDMORE, OWINGS & MERRILL. *Mechanical Engineers:* SYSKA & HENNESSY. *Air Conditioning Contractor:* BAKER SMITH, INC. *Interior Design Consultant:* ELEANOR LEMAIRE.

Close-up view of Uni-Flo Rectangular Diffusers is seen in this third floor office photograph. Mounted in aluminum strip, diffusers lead directly from air valves installed above luminous ceiling panels. Individually adjustable diffusers simplify system balancing.

Like a modern showcase, the interior of Manufacturers Trust Company's office gleams with light on a rainy night. Huge 10x22 foot panes of plate glass face the second floor mezzanine. Unusual air conditioning problems posed by the glass walls were solved satisfactorily.

No fixed teller positions is a new idea in commercial banking. During busy hours, tellers roll mobile currency buses along the line to make room for extra help. Uni-Flo Rectangular Ceiling Diffusers blend with modern luminous ceiling construction providing inconspicuous air distribution.

One Uni-Flo High Velocity Valve can serve several diffusers when installed at a low velocity branch duct take-off from a high velocity trunk duct. Or a "package" is available, consisting of an air valve, sound control chamber, and single diffuser.

. . . get reliable information and performance data from the pioneer in high velocity systems!

Phone nearby Field Office
or write us for your copy of Uni-Flo High Velocity Catalog No. 6398. Fully illustrated manual on high velocity applications and techniques.

Barber-Colman Company

DEPT. V, 1102 ROCK ST., ROCKFORD, ILLINOIS, U.S.A.

Field Offices in Principal Cities

Air Distribution Products • Automatic Controls • Industrial Instruments Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery.

(*Continued from page* 148)

Job Site Storage Shed

A mobile storage enclosure for materials spotted on the job is announced by Material Master, Inc., Chicago, Ill.

The enclosure can be transported from job to job by an automobile with one worker in attendance. It is made in lengths from 42 to 128 in. It is 45 in. wide and 50 in. high, and its total weight is less than 1500 lb. Constructed of heavy gage, galvanized rolled steel and a hardwood base, it is made to save contractors the expense of constructing wooden buildings or other makeshift methods to house materials necessary for each job.

Suppliers can deliver direct to the enclosure in order to save the cost of re-transporting material.

More information? Circle Item 44 on postcard, page 153.

Reinforced Flexible Hose

To protect and reduce the exterior wear from contact with rough and abrasive surfaces, Flexaust hoses and Portovent retractable ducts are available from The Flexaust Co., New York, N. Y., with an added vinyl wear strip. The wear strip is bonded over the spiral wire reinforcement and where the hose is most exposed to abrasion and damage.

In many spot air conditioning, ventilating, dust collection, fume control, and material handling uses, where lightweight flexible hoses are frequently dragged over rough surfaces, the reinforcement assures a longer service life.

The wear strip is available for flexible hoses in sizes from 4 to 12 in. ID, and for retractible ducts in sizes from 3 to 36 in. ID.

More information? Circle Item 45 on postcard, page 153.

Cooler Is Built Into Wall

Built-in-the-wall air conditioners for installation in the individual rooms of new apartment buildings are announced by Amic Mfg. Corp., Long Island City, N. Y.

With a cooling capacity of 11,000 Btu per hr for the 1-hp units and a 50% fresh air intake, the air conditioners offer individual selection of cooling, ventilating, or exhausting operations or combinations of the three.

By means of an overflow design, involving the drainage of excess moisture into the return lines of the heating system, the spilling of condensation on the exterior wall is prevented. The units can be constructed from mass-produced components and are part of the basic construction of a building.

The air-conditioners have exterior louvers made of anodized aluminum that are flush with the facade of the building and decorative convector covers for room interiors. Each louver is 2 in. wide and angled to make the unit weatherproof without further treatment. They prevent rain or snow from entering a room. A V-pattern built down the center of the louvers also prevents the short circuiting of the flow of air.

The units are encased in galvanized steel, 1/16 of an inch thick. All inner components are designed for heavy duty, with oiling necessary once a year through two oil holes built into each unit.

Quieter operation is obtained by using four centrifugal blower fans to move a large amount of air at low velocity instead of a small amount at high velocity.

Installation is accomplished by the use of a steel sleeve that is part of the air conditioner and which is delivered ahead of time to be built into the building wall. After the building is enclosed and the electrical wiring and heating installations are completed, the conditioners can be set in place.

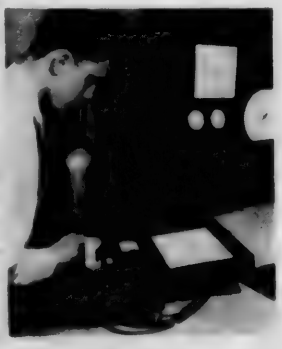
Each unit works under its own power and air supply and is independently serviceable. It is not part of a central installation. The power consumption is in the hands of each individual tenant.

More information? Circle Item 46 on postcard, page 153.

Dewpoint Indicator Is Portable

A portable, manually-operated dewpoint indicator for the measurement of moisture in gases is announced by General Electric Co., Instrument Dept., Lynn, Mass.

Designed for applications where only periodic checks of dew-point are desired, the indicator determines the moisture content of a gas by measuring the temperature at which the moisture begins to condense. This is done by cooling a mirror surface and observing the temperature at which dew first forms. The dewpoint temperature directly describes the water vapor content of a gas.



Useful for monitoring the moisture content of furnace atmospheres in the heat treatment of metals, the dewpoint indicator is also designed for use by manufacturers of gases, and by large users of gases. In experimental installations, such as wind tunnels and high altitude chambers, it can be used to measure moisture content in order to simulate specific atmospheric conditions.

The indicator gives readings over the range of dewpoint temperatures from ambient to −100 deg F (0.0003% moisture by volume in air). It requires no electrical outlet, operating on a self-contained battery, and can be used to measure different gases in rapid succession. It weighs 16 lb.

More information? Circle Item 47 on postcard, page 153.

(*Continued on page* 152)

One of the country's largest air-terminal buildings, at San Francisco International Airport, uses Beth-Co-Weld Pipe in sizes from ½ in. to 12 in. *Plumbing and Heating Contractors:* Anderson and Rowe; *Jobbers:* Heieck and Moran, and P. E. O'Hair, all of San Francisco.

Beth-Co-Weld Pipe is used in sprinkler system for this new Simplex Paper Company's bag manufacturing plant, Jacksonville, Fla. Installation by Moore Pipe & Sprinkler Company, Jacksonville.

New Air-Terminal Building . . . New Factory Both with Beth-Co-Weld Piping

Whether it's for a factory, air-terminal building, or some other type of construction, you'll make a wise choice when you select Beth-Co-Weld steel pipe for the heating and plumbing lines, and for sprinkler systems.

Beth-Co-Weld is good, sound, dependable pipe, manufactured by the continuous-weld process. It is uniform in quality, and is easy to work.

Beth-Co-Weld is furnished in sizes ranging from ½ in. to 3 in., standard-weight and extra-strong, and can be supplied either in random lengths or in uniform 21-ft lengths, plus or minus 1 in. It also comes in 3½ and 4 in. sizes, standard-weight only, in lengths of about 22 ft. Order Beth-Co-Weld today from your jobber.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

(*Continued from page* 150)

Plastic Fans Remove Fumes

A line of Rigivin plastic fans (rigid vinyl, high impact type) and Rigidon plastic fans (glass fiber reinforced plastic) to handle fume removal under corrosive conditions is available from Heil Process Equipment Corp., Cleveland, Ohio.

The solid Rigivin fans are designed for use with strong acid or alkali fumes where maximum corrosion resistance is required. The Rigidon fans are recommended for most acid services and high temperature applications to 200 deg F.

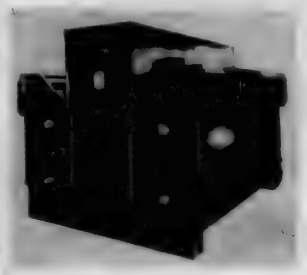
The smooth interior surfaces of the plastic material increases the fan's efficiency and limits the buildup of solids carried by the fumes. The solid plastic construction affords exterior as well as interior corrosion resistance.

The fans are available with variable discharge positions. They are also made for either plain or flanged inlet and outlet connections.

More information? Circle Item 48 on postcard, page 153.

Industrial Heat Exchanger

A heat exchanger providing water saving in industrial cooling and control of temperatures (within 2 deg F) is announced by Niagara Blower Co., New York, N. Y. The machine, which is patented, is named the Panel Casing Aero heat exchanger. It cools by evaporation and obtains the temperature control by modulating the use of outdoor air.



The fluid to be cooled flows through two parallel-mounted coil sections, both of which are continuously kept drenched with a water spray. A portion of this water evaporates while the balance is recirculated by a pump. Air enters through dampered intakes above the coils, travels downward through the sprays and then enters a central plenum between the two sections, at which point the entrained moisture is eliminated. The air then moves upward and a propeller fan ejects it into the atmosphere.

Cooling capacity varies directly with the heat input load. The gradual action of the dampers, admitting more air when more cooling is called for, controls the evaporation of the water spray and holds the desired temperature. If heat is required instead of cooling it is provided either with steam or electricity by a heater in the spray water tank.

The equipment is designed to be assembled on the installation site; the casing is shipped as flat panels instead of box-like shapes. The tank is first installed on the owner's foundations or, at his option, may be built of concrete according to drawings furnished. The coil sections are assembled over the tank and enclosed in panels. Above them the intakes are installed and over the central portion the fan section is erected. This creates the central plenum.

All panels are removable, any of them may be taken down for access to the interior, painting or maintenance work.

The heat exchanger may be installed outdoors, on the ground, or on a roof. In this model there are four sizes affording capacities from 7,000,000 to 18,000,000 Btu per hr under standard conditions. The maximum space required in the ground plan is 194 by 140½ in.; the height is 125⅝ in. The weight range is from 9300 to 20,500 lb, approximately. The manufacturer also builds both smaller and larger units in other types.

More information? Circle Item 49 on postcard, page 153.

Pipe Fitting Is Non-Corrosive

An industrial fitting, named Tri-Clamp, has been designed for corrosion applications by Ladish Co., Tri-Clover Div., Kenosha, Wis.

Made of stainless steel, the fitting consists of a flange-type ferrule, a molded gasket which fits into the grooved ferrule lip, and a spring clamp with a bolt-type coupler assembly that is secured to the clamp ring.

To install the fitting, attach the ferrule to stainless steel tubing or pipe, insert the gasket into position, slip the clamp over the ferrule, and tighten it into position.

Catalog 1055 contains additional information on the fitting's applications.

More information? Circle Item 50 on postcard, page 153.

Packaged Dust Collector

A packaged dust collecting unit for use in industrial plants where dust control and removal are necessary is made by Green Fuel Economizer Co., Beacon, N. Y.

The unit consists of an Aerodyne louvered cone and one or more fiber filter packs in series. The cone removes from the air, or gas, coarser and medium particles; the filter packs remove the submicron particles and many of the undesirable condensable elements.

Classed as the Type G. W. F. Aerodyne, the unit is available in capacities ranging from 1000 to 10,000 cfm of free air. The dimensions are 3 x 3 x 7 ft for the 1000-cfm unit and 5½ x 5½ x 14 ft for the 10,000-cfm unit. Power requirements range from 1½ to 15 hp with the motor assembled with the unit.

For all practical purposes the packaged unit will remove solids and most condensable fumes. The dust free air can be used over again or vented to the atmosphere without danger of pollution.

More information? Circle Item 51 on postcard, page 153.

(*Continued on page* 158)

ACH&V's *Ad-Digest* AND PRODUCT INFORMATION SERVICE

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement.

NOTE: All advertisements are digested here except those received too late for inclusion. The Index of Advertisers lists all the advertisements in this issue.

Use the postcard below for catalogs, new equipment and materials, as well as Ad-Digest items.

STEAM TRAPS. Inside front cover. Tips on trapping unit heaters for full output and low maintenance include: trap supply lines; use one trap for each heater; size traps properly; and install traps correctly. Diagrams, selection data, tables, and additional recommendations are contained in this steam trap manufacturer's bulletin which also includes Btu per hr output ratings for all models of thirty makes of unit heaters .....Item 82

POWER ROOF VENTILATORS. Page 1. Three new, low-silhouette roof ventilators include: one for quiet operation on schools and hospitals that runs at low speeds; another vertical discharge ventilator for oil or grease laden air that exhausts air straight up at high velocity; and a ventilator in a weatherproof housing for general usage. Units are made with capacities up to 40,000 cfm. Three new catalogs are available .....Item 83

PLANT HEATING. Page 2. A socket screw products plant with more than 600,000 sq. ft. of floor space is heated and ventilated by unit heaters. Wall convectors offset heat loss below windows. The same manufacturer's radiator traps, valves, and dirt strainers are used in the plant's steam heating system. .....Item 84

AIR CONDITIONING CONTROLS. Page 4. A drug laboratory has an air conditioning control system for an auditorium with 900 seating capacity, executive offices and dining room, cafeteria and animal rooms, also controls for tablet machines. The assistance of an experienced engineer is offered to help select the right type of automatic control for temperature, humidity, or pressure requirements. .....Item 85

MULTIPLE ALUMINUM INSULATION. Page 7. Multiple accordion aluminum insulation, installed between the joists, have an absorptivity to heat rays of 3%; reflect them at the rate of 97%; and emit them at a rate of only 3%. The continuous metal sheets, up to 750 ft. long, have almost zero permeability to water vapor. ASHAE booklet is available. .....Item 86

CONDENSERS AND CONDITIONERS. Page 9. Refrigeration and air conditioning condensing units are made in sizes up to 75 hp and packaged air conditioners in models up to 20 hp. The condensing units are for commercial and industrial applications; the air conditioners are for residential or business installations...Item 87

SERIES HOT WATER SYSTEM. Page 11. A series hot water system of heating and ventilating can save 20% or more of the construction, equipment, and installation costs, the supply and return for the unit ventilators requires no pipe trenches, main, runouts, and pipe covering. Smaller pipes and pumps are used, and labor costs at the site are reduced. Descriptive publication is available. .....Item 88

HIGH PRESSURE SYSTEM. Pages 12-13. A double duct mixing plenum high pressure air distribution system features heating and cooling zone control using wall units located under all windows and ceiling units installed in the dining areas of a new bank. The units mix and discharge varying proportions of heated and cooled air so that one area can be heated while another is cooled. Catalog and bulletin are available. .....Item 89

POWER ACCESSORIES. Pages 14-15. Use this combination of control motor and V-belt drive to save design time, cut manufacturing costs, and insure efficiency. Nationwide service is available from 76 district offices and almost 100 certified service shops located in industrial areas in the country. Engineering literature available. .....Item 90

TEMPERATURE MEASUREMENT. Page 16. This company's temperature measuring instrument is available for balancing hot water heating systems, reading floor, wall or ceiling temperatures, checking refrigerated coils, insulation and all other low temperature surfaces. Bulletin available. .....Item 91

METAL FRAME PIPE RACKING. Page 17. Heavy lines are easily supported on this sturdy metal framing. Clamps, concrete inserts, hangers and rollers are among the many accessories for the framing. No welding or drilling is required to install it, and additions or alterations can be made at any time. Information on a motion picture film about the framing is available. .....Item 92

AIR CONDITIONING LINE. Page 18. Window air conditioners, packaged units from 2 to 20 tons, condensing units to 100 tons using F-12 or F-22, multi-zone units serving 2 to 8 zones, and packaged liquid chillers from 7½ to 100 tons are all available from this line. .....Item 93

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

BOILER WATER CONTROL. Page 18. A pump control, low water cutoff, and alarm are combined in one control for steam pressures up to 250 psi. Its Alnico magnetic switches operate on repulsion to give a powerful and positive action in both opening and closing. The control is also made with integral water column. Control bulletin is available. .....Item 94

CENTRAL STATION EQUIPMENT. Pages 20-21. This company's line of central station equipment enables its dealers to take on any air conditioning job. The line of equipment includes Freon compressors, liquid chillers, induction circulators, evaporative units, and air handling units. .....Item 95

GALVANIZED SHEET STEEL. Pages 22-23. Anything that can be made of steel sheets can be made of galvanized sheets. The sheets can be worked to the limits of the base metal with never a trace of chipping or flaking of the coating. Full information is available. .....Item 96

FANS IMPROVED BY RESEARCH. Pages 24-25. Aerodynamic research on this company's fans have made them quiet, non-overloading, and more efficient. Handling from 500 to 500,000 cfm, the fans have a sharply rising pressure characteristic throughout normal performance range. In smaller sizes, 38 in. and under, fan arrangements are convertible. Booklet available. .....Item 97

CEILING-MOUNTED COOLERS. Page 26. Air conditioners that are attached to the ceiling or mounted on a shelf do not use floor space and are compact, self-contained packages with motor, compressor and condenser all sealed inside the unit. Air-cooled units are made in 3 and 5-ton sizes, and water-cooled units are available in 3, 5 and 7½-ton sizes. Booklet is available. .....Item 98

CAST IRON BOILER. Page 28. This cast iron boiler has been designed specifically for horizontal rotary oil burners. The boiler, for burners using heavy oil, has a large firebox volume, a high base, a steel front plate for installing the rotary burners, and an enameled steel jacket lined with fiber glass. Engineering data are available. .....Item 99

DESIGN MANUAL. Page 29. In six simple steps, an authoritative manual gives the procedure for quickly and accurately sizing the pump and piping for any cooling tower application. Tables and charts and work sheet are included in the manual. Free copies are available. .....Item 100

LOW VELOCITY AIR DIFFUSERS. Page 30. Low velocity air diffusing panels, once installed flush in the ceiling need not be moved, altered in any way, or even adjusted when partitions are removed to suit tenants' changing needs. The diffuser introduces conditioned air through perforations in standard acoustical ceiling pans at low velocity. Detailed literature is available. .....Item 101

VENTILATING FAN. Page 31. Three features of this ventilating fan are a properly proportioned housing, self-aligning bearings (choice of sleeve or anti-friction type), and a large, smooth inlet collar. Inlet guide vanes assure full rated delivery with minimum turbulence. Fan bulletin is available .....Item 102

INQUIRY CARD

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176
177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192						

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AIR CONDITIONING EQUIPMENT. Page 32. Twelve air conditioning units and ten heating and ventilating units went into a can company's new research and development center. The same air conditioning equipment manufacturer supplied the can company's ten other manufacturing and research plants. .....Item 103

INDIVIDUAL ROOM HEATING. Page 33. With a thermostat in every room, the occupants of each room or office can select any temperature desired from the individual room units of this heating system. Flexible copper tubing carries low pressure steam to each room unit. Literature is available. .....Item 104

STEEL PIPE. Page 36. Almost 300 tons of steel pipe were used in the air conditioning, heating, power installation of an ultra-modern skyscraper. Seamless pipe, ranging in diameter from 6 to 20 in., was used as air conditioning carriers. About 42 tons of seamless pipe, ranging from 2 to 14 in. diameter, were used for heating and fan rooms. Information and assistance are offered. .....Item 105

AIR DIFFUSERS SOLVE PROBLEM. Page 37. A solution to air conditioning a department store, without disrupting sales, was worked out by one engineering firm. The air diffusers permit the use of smaller than ordinary ducts. The company's engineers have prepared a 48-page text book on the subject. .....Item 106

REFRIGERATING MACHINES. Page 38. A new building of a savings and loan association, including the lobby, conference and accounting areas, community room and lounge, is air conditioned with two of one manufacturers's compressors. Each refrigerating machine is driven by a motor of 40 hp. .....Item 107

TEMPERATURE CONTROL. Page 39. A temperature regulator that controls the flow of steam, water, or gases has a powerful bellows and a minimum of valve stem friction. Its bronze union connections save installation time and labor. .....Item 108

AIR FILTER LINE. Page 40. A line of air filters includes 1, 2 and 4 in. thick filters available in all sizes and most metals; a completely automatic filter that washes and re-oils itself in sizes to meet any cfm requirements; and a selection of grease eliminators. Catalog is available....Item 109

GALVANIZED DUCT WORK STEEL. Page 41. Galvanized steel is made in modern mills and by modern methods for gutters, downspouts, and ducts. It is available in coil and cut lengths in gages of 16 to 30, inclusive. The maximum width available is 42 in., and the maximum cut length available is 168 in. For standard roofing and siding it is made to conform to ASTM specification. .....Item 110

INDUSTRIAL HEATERS. Page 42-43. A complete line of industrial heating and ventilating equipment is made for comfort heating and ventilating in plants and is also used for process drying, curing, air cleaning and other special heat-drying-ventilating needs. It can be installed anywhere on walls, ceiling, or floors, with or without ducts. Information on the various equipment is available. .....Item 111

WATER CHILLERS. Pages 44-45. Water chillers with capacities from 45 to 800 tons, in 11 different compressor sizes, feature hermetic construction, fully automatic operation, and modulation down to 10% of capacity. No multi-level base is required. Complete information on the line is available. .....Item 112

PACKAGED BOILER UNIT. Page 46. A packaged boiler unit is a factory integrated and wired unit with all equipment coordinated into one heating package. It is rated on the basis of 8.2 sq. ft. heating surface per boiler hp with guaranteed gross output based on 5.0 sq. ft. of heating surface per boiler hp. Catalog is available giving details. .....Item 113

COPPER PLUMBING. Page 47. One hundred thousand pounds of copper tube, ranging in size from ⅛ to 12 in., is used in the hot and cold water lines, sanitary drainage systems, and roof drainage lines of a 42-story building. Standard 20-ft. lengths eliminate many joints. Descriptive literature is available. .....Item 114

INSULATED PIPING SYSTEMS. Page 48. A manufacturer of prefabricated insulated piping takes pride in on-time delivery. Contact the manufacturer's representative early in the planning stage to receive help on scheduling delivery and on technical information as well. Catalog is available. .....Item 115

UNIVERSAL PUMP. Page 49. A universal pump designed for operation in liquid heating and cooling systems needs no vibration eliminators or flexible connections. Among the pump's features are: motors with lubricated bronze sleeve bearings; universal motors through 5 hp; self-aligning, spring-type coupler; a removable bearing frame; and a mechanical seal. Capacity data is available. .....Item 116

MAIN STEAM VALVES. Page 50. Two 250-lb iron body angle valves, in 6- and 8-in. sizes, gave 40 years of uninterrupted service on the main steam leads from plant boilers. In all grades the manufacturer's iron valves exceed the requirements of equivalent ASTM specifications. Help in ordering is offered. .....Item 117

COPPER TUBE. Page 53. One manufacturer of copper tube welcomes stiff-necked specifications because the copper it forms into tube is first refined in its own plant. A completely integrated operation permits a standard of quality control from raw materials to packaged tube. Products are available through wholesale distributors throughout the 48 states. .....Item 118

OIL BURNERS. Page 54. Twenty oil burners provide heat for 9 apartment developments and power for a 12-story manufacturing plant. The oil burners automatically preheat the oil to an efficient temperature before firing. This enables users to burn heavy fuel oils. The flame is adjustable to any fire box, and the installation is adaptable to any boiler room layout. Catalog and information are available..Item 119

ACOUSTICAL DUCT LINER. Page 55. A flexible, semi-rigid glass fiber insulation is designed specifically as an acoustical duct liner, with excellent sound-absorbing qualities. Installed in a plenum and short supply and return ducts, the liner makes the difference between a satisfactory and unacceptable air conditioning job. Local stocks are maintained in 57 cities. .....Item 120

ROOF VENTILATORS. Page 56. These aluminum roof ventilators are available in two models. The low silhouette model has backwardly inclined, non-overloading, centrifugal fan wheels and is made in a wide range of capacities. The other model is designed for low parapet building and is available in fan wheel sizes from 24 to 48 in. Book with performance data available. .....Item 121

COPPER TUBE. Page 57. Through all phases of production of this copper tube, constant metallurigcal, hydrostatic, physical and visual tests maintain the highest and most rigid standards of quality. Sold through wholesalers only. .....Item 122

FAN UNITS. Page 58. The design of this company's fans is highly efficient, yielding to a maximum air volume-to-power ratio. Blades are of true airfoil shape, and are readily adjustable for maximum flexibility to meet varying conditions. Thick steel casings are used in the sturdy construction that smothers operating noise. Bulletin available. .....Item 123

LINE OF CENTRIFUGAL PUMPS. Page 59. This line of centrifugal pumps for air conditioning service includes a full range of sizes from 1/3 to 2 hp, motor-mounted or belt-driven models, with two casing sizes, a bronze impeller, removable bronze wearing rings, a rotary seal, and a corrosion resistant shaft. The pumps are available with capacities to 90 gpm and with heads to 125 ft. Write for centrifugal pump bulletin. .....Item 124

AIR HANDLING EQUIPMENT. Page 60. Over 27,000 cfm of air is filtered, conditioned and, recirculated every minute in a suburban department store that has no exterior openings except for entrance and exit doors. Each store level has its own supply and return system which furnishes conditioned air, summer and winter, to maintain an even and desirable temperature. .....Item 125

AUTOMATIC HUMIDIFIERS. Page 61. Automatic humidifiers, made especially for convector radiators, are available in both 2 and 4 trough units in 10 different sizes with evaporating capacities of 1 to 5 gal. per day. Only 5⅛ in. deep, the humidifier fits in shallow convector cabinets. Details are available. .....Item 126

DUCT WRAP AND LINER. Page 62. Glass fiber duct wrap and liner insulation is easy to manage on tall ladders or scaffolds and does not require special tools or skills for installation. It is available in blanket form up to 72 in. wide, 5 in. thick and from 50 to 200 ft. long, depending on thickness. The nearest distributor is listed in the yellow pages of the telephone directory. .....Item 127

HEATING CONTROL THERMOSTAT. Page 63. A thermostat that is styled to complement the decoration of any home has a single, large numbered dial that is slanted for perfect vision, and a temperature selector that is directly under the indicator needle. The thermostat requires only two wires and replaces any two or three wire thermostat. .....Item 128

ROOF VENTILATORS. Page 64. Positive removal of heat and fumes from a newspaper plant is effected by one company's ventilating fans. The fans remove ink mist and other fumes from the giant press, exchange the air in photographic dark rooms and above the linotype machines. Direct drive units are available from 150 to 11,000 cfm; the belt drive units are available from 3500 to 65,000 cfm to 4 inches of water. Further information is available. .....Item 129

BOILER AND STEAM GENERATOR. Page 65. This one-piece unit, fire-box type, high pressure boiler is made in twelve sizes, 250 to 2500 sq. ft. heating surface. The packaged steam generator is completely automatic in operation, requires a vent only, and has a minimum heating surface of 5 sq. ft. per boiler hp. It is available in sizes from 20 to 350 hp. Bulletins on each are available. .....Item 130

TEMPERATURE REGULATORS. Page 66. When installing a new or replacing an old temperature regulator, look for packless construction; a guarantee against wire drawing; a broad control range; easy maintenance; double duty and self-operation. These points are important, and this manufacturer's regulators offer all these features and more. Bulletin on temperature regulators is available. .....Item 131

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FIRST CLASS PERMIT NO. 33, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

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AD-DIGEST SERVICE

STEAM GENERATORS. Page 67. This company's steam generator offers savings in first cost. Purchase price includes complete unit. Just set on level concrete floor and connect to service lines and breeching. Because of a minimum of supervision, lower manhour requirements for maintenance, and 80% thermal efficiency savings in operation are also realized. Bulletin is available. .....Item 132

CABINET AIR CONDITIONER. Page 68. Recessed in the wall or concealed behind a partition or false ceiling, a cabinet air conditioner provides warm or cool air for rooms, entrances, and corridors. Five models are made from 120 to 640 EDR. Bulletin is available. .....Item 133

GENERAL PURPOSE FAN. Page 71. General purpose fans are made in three types and eight basic sizes with capacities from 1200 to 19,000 cfm. These include both direct connected and belt driven models. Fan bulletins are available. .....Item 134

ONE PUMP WITH SIX MOUNTINGS. Page 72. A single air conditioning pump can be mounted by six different methods. You can get a single set of operating characteristics using four different models that can be installed in any of six different ways. Bulletins are available. .....Item 135

FORMAL PLANT OPENING. Page 73. An invitation is extended to attend the formal opening of a new plant for manufacturing heating, air conditioning, and refrigeration coils. Up-to-date machinery and equipment have been installed in the 167,000 sq. ft. of space. .....Item 136

PACKAGED STEAM PLANT. Page 75. Packaged steam plants provide quality process steam for widely separated operations and may be set up on any floor capable of supporting their weight and put into operation within 24 hours of delivery. Fully automatic, and burning oil, gas, or both in combination, the steam generators are made in 18 sizes. Steam generator catalog is available. .....Item 137

VALVES, TRAPS, GAGES. Page 76. A skyscraper containing a million sq. ft. of office space is equipped with one company's valves, traps, and gages wherever equipment of the company's type applies. The company's line includes pressure gages and float traps. .....Item 138

BLOWERS. Page 77. A line of blowers includes: a squirrel cage type with forward curved blades, slow speed, and quiet operation; and a power fixed type with backward curved blades and quiet operation at medium speed. Bulletins describing each type are available. .....Item 139

RADIANT HEATING PIPE. Page 78. Radiant heating steel pipe was chosen for heating an airplane hangar because when snow blows in open hangar doors it will melt immediately instead of creating a hazardous condition. Buried in the concrete floor, the pipe will provide adequate heating service for years to come. Information and service is available. .....Item 140

CONDENSATION PUMPS. Page 79. Single and duplex condensation pumps, designed to operate at a wide range of pressures and at extremely high temperatures, are made with ratings to 150,000 sq ft. EDR. Catalog is available. .....Item 141

ACID RESISTING DRAINPIPE. Page 80. Drainpipe for permanent drain lines to handle acids and other severe corrosives is a high silicon iron that is corrosion resistant throughout. A complete line of bell and spigot pipe and fittings is carried in stock by leading wholesalers throughout the country. Details are available in two bulletins. .....Item 142

HOT WATER BOILERS. Page 81. Sixty-four cast iron boilers of different sizes and capacities provide heat and hot water for 64 buildings with a total of 380 four- and five-room apartments. Available with input ratings from 136,000 to 745,500 Btu per hr, the gas-fired boiler has an integral built-in tankless hot water heater capable of supplying 8 gpm of hot water. Boiler bulletin is available. .....Item 143

REMOTE ROOM AIR CONDITIONERS. Page 82. One of the largest air conditioning installations ever made in a St. Louis office building, totalling 1900 tons, consists of over 1000 remote room air conditioning units that will permit occupants of each office to regulate temperatures to their own preference in summer and winter. Air conditioning bulletin is available. Item 144

STEAM BOILERS. Page 83. An integral-furnace boiler supplies steam for heating, hot water, and processing operations in a toiletries plant's chemical and packaging divisions. One unit provides 15,000 lb of steam per hr at a pressure of 150 psi, burning up to 1600 gal of No. 5 oil in 24 hrs, depending upon load. Boilers are available in standard sizes with individual capacities to 40,000 lb of steam per hr and pressures to 235 psi. Detailed descriptions of the boilers are available in bulletin. .....Item 145

STEAM GENERATORS. Page 84. Four oil- and gas-fired steam generators supply both hot water and heat for an entire hotel, as well as process steam for the kitchen cookers, steam tables, and dishwashers. Three are 125-hp low pressure units burning No. 6 fuel oil. Information is available. .....Item 146

STAINLESS STEEL VALVES. Page 85. Stainless steel, Y-globe valves lower costs in a wider range of corrosive services. The Y pattern permits full flow, nearly equal to that of a gate valve. The disc, packing, and gasket are made of Teflon. Stainless steel valve booklet is available. ...Item 147

COPPER WATER TUBE. Page 141. One contractor installs copper, whether or not codes call for it, when imbedding plumbing and heating lines or radiant panel heating coils in a concrete slab. Fewer joints are necessary and copper is non-rusting. Technical advisory service is available to help solve installation problems. .....Item 148

PLUMBING FIXTURE FITTINGS. Page 143. Mounting off-the-floor plumbing fixtures on behind-the-wall fittings and carriers makes it easy to maintain hospital-like standards of cleanliness and sanitation. All of the stress is carried by the carrier system; no stresses are transmitted to the wall. Booklet on restroom design is available. .....Item 149

COOLING TOWERS AND CONDENSERS. Page 145. Cooling towers, in 2 to 120-ton capacities, and water-cooled condensers, in 1/3 to 25-ton capacities, are matched to work with each other. The wetted deck surfaces of the towers carry a 20-year guarantee against rotting or fungus attack. The condenser's tubes can be cleaned by a mechanical cleaning tube. Detailed specifications are available. .....Item 150

SOLENOID MOTOR CONTROL. Page 147. Manufacturers and users cannot tolerate trouble in air conditioning and refrigeration control. Solenoid starters are available in 8 sizes up to 300 hp, 230v, and 600 hp, 440-550v. The controls are reliable due to simplicity of design and thinking in terms of the user of the apparatus. Bulletins are available. .....Item 151

HIGH VELOCITY AIR VALVES. Page 149. A high velocity air distribution system is one of the features in Manhattan's glass-box bank. One high velocity air valve can serve several diffusers when installed at a low velocity branch duct take-off from a high velocity trunk duct. A package is available, consisting of an air valve, sound control chamber, and single diffuser. An illustrated manual is available. ...Item 152

DRY EXPANSION COOLERS. Page 157. Six dry expansion Freon coolers of this company were engineered and installed in a large candy manufacturing plant. Two-circuit type coolers which chill a glycol solution are located in the basement and the third and fifth floors. The re-heating principle is used to cool the air and bring it to the proper humidity. Illustrated literature and engineering suggestions are available. .....Item 153

SELF-CONTAINED BOILERS. Page 161. Self-contained boilers, for a new steam plant or modernizing, have four-pass construction, forced draft, 5 sq ft of heating surface per boiler hp, and a guaranteed 80% thermal efficiency when firing with oil. The boilers, for steam or hot water, heating or processing, are made in sizes from 15 to 500 hp, and 15 to 250 psi. Catalog is available. .....Item 154

WATER CHILLERS. Page 163. A line of air-cooled and water-cooled chillers for air conditioning requirements includes a model for homes and small commercial buildings in 2- and 3-hp sizes; a packaged water chiller with air-cooled condenser in 2- and 3-hp sizes; and a model for medium and large sized buildings in sizes from 7.5 to 75 hp. Information on the line is available. .....Item 155

COOLER USES NO FLOOR SPACE. Page 165. An air conditioning unit for remote installations on new or old construction requires no floor space and can be used with Freon or with hot and cold water. The unit can be installed in vestibules, overhead entrance ways, plenums, closets, or hallways with or without false or furred ceilings. It provides horizontal discharge to one or several adjacent rooms. The manufacturer will send bulletin and specifications. .....Item 156

CABINET UNIT HEATERS. Page 166. Cabinet unit heaters for cold reception rooms, lobbies, vestibules, and entrances of commercial establishments are made in floor, ceiling, and semi-recessed wall models for both steam and hot water. Every unit has a blower, directional air louvers, and non-ferrous tubes and fins. Model sizes, feature story, and selection data available. Item 157

ROOF AND WALL EXHAUSTERS. Page 167. Low contour roof exhausters and button-style wall exhausters are architecturally designed to blend with modern architectural structures. Belt drive centrifugal roof exhausters are made with capacities up to 13,000 cfm. No platforms, louvers or penthouses are necessary for roof installation. Catalogs are available. .....Item 158

POWER FASTENERS. Page 168. Powder-powered fasteners for fastening to steel or concrete speed work on ladders and scaffolds because they can be used with one hand. They can be changed over for light, medium, or heavy duty and have exactly the fastener needed. The fasteners can be kept nearby for ready service. Complete information is available. .....Item 159

Use this digest to locate and refer to items and advertisements appearing in this issue, then fill out and mail the prepaid postcard to request further information.

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

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23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176
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ELECTRONIC AIR CLEANER. Page 169. Based upon the principle of electrostatic precipitation, an air cleaner charges the dust particles which are then attracted to and held by charged collector plates. By this method, the cleaner removes the dust, smoke, soot, and microscopic particles from the air. Combinations of two basic cell sizes make possible complete installations of any desired capacity. Bulletin is available. .....Item 169

CABINET UNIT HEATERS. Page 170. Thorough engineering research preceded the manufacture of these cabinet unit heaters. Alternative features and designs were analyzed from the standpoint of proved practicality and efficiency. Complete information on the cabinet unit heaters is available. .....Item 170

FAN COOLERS. Page 171. Eliminate water problems by using fan coolers for any size compressor, regardless of tonnage. Stands, hoods, and wind deflectors are available for simplified outside mounting. Bulletin available. .....Item 171

INTERIOR FIRE-PROTECTION. Page 172. It pays to figure on a line of interior fire-protection equipment that includes everything that might be called for in standpipe type fire protection. Some items actually cut installation costs, and new items are brought out all the time. .....Item 172

DRAFT CONTROLS. Page 173. Draft controls for coal and oil-fired heating plants are heavy-duty, commercial models in 28- and 32-in. sizes. They are also available in 6- to 24-in sizes for domestic and commercial installations. Controls for gas and gas-oil fired heating plants are also made in sizes 8- through 32-in. .....Item 173

AUTOMATIC BOILER. Page 174. An automatic boiler can be opened for cleaning or inspection by one man in less than one-half hour, for it has hinged doors at both ends. Fully automatic, the boiler is used for hot water and high or low pressure steam applications. Units range from 20 to 500 hp and can be gas, or oil, or combination fired. Catalog and name of nearest distributor are available. .....Item 174

MECHANICAL LUNGS. Page 175. Highly flexible in purpose or position, this backward blade centrifugal fan is designed for use in heating, ventilating, and air conditioning systems, power plant installations, and industrial processes. .....Item 175

PORTABLE CONTACT PYROMETER. Page 175. A portable contact pyrometer will give temperature readings instantly of any surface, metallic or non-metallic, flat, curved, stationary, or revolving. For checking the temperature of steam traps, motors, and bearings, eight standard F-scale ranges are available up to 1200 deg. Details of the pyrometers are contained in a bulletin. .....Item 176

STEAM TRAPS. Page 176. These steam traps are designed to offer simplified piping connections without the use of narrow thin-walled passages. They are available with straight-through and elbow installation in all sizes. .....Item 176

AIR DIFFUSERS. Page 177. Air diffusers with diffusing vanes provide air patterns unlimited without blank-off. The diffusers are made with square and rectangular outlet design. The company's engineering staff and laboratory resources are available. .....Item 177

MOISTURE CONTENT CONTROL. Page 177. This air conditioning method dries air directly by using a moisture-absorbing liquid spray. It makes humidity control a separate function from lowering or raising temperatures and saves the refrigeration commonly used to condense moisture. It also makes re-heat unnecessary in most cases. Descriptive bulletins are available. .....Item 178

OIL LEAK DETECTION SYSTEM. Page 178. An oil leak detection system continuously monitors the purity of condensate leaving steam-type fuel oil heaters. It protects the boiler by removing oil contamination from the feed-water cycle. The system is engineered to the special requirements of each installation. Details are available. .....Item 171

LIQUID DEPTH GAGES. Page 178. Remote reading liquid depth gages for tanks 20 in. to 50 ft deep can be installed on tanks above or below the ground and up to ½ of a mile away. The gage can be used for commercial and industrial liquid storage tanks and for domestic installations with buried tanks. Bulletin is available. .....Item 172

GAS UNIT HEATING. Page 179. Gas unit heating offers adaptability to future construction; ease of installation; response to changes in temperature; low initial cost; savings on valuable floor space; and extra heat for trouble spots. Catalog and other information is available. .....Item 173

GAS OR OIL BURNERS. Page 180. These gas or oil burners combine low installation and maintenance costs with added years of dependable service. Information is available. .....Item 174

ORNAMENTAL GRILLES. Page 180. Ornamental grilles are available in steel, stainless steel, brass, bronze, or aluminum in a variety of designs and finishes. They are ideal for convector and radiator enclosure fronts for modernization or new construction. .....Item 175

SPLIT CAPACITOR MOTORS. Page 180. A new type, permanent split capacitor motor makes practical larger direct-drive blowers. Features of the motor include: elimination of starting switches and relays, low starting current, high power factor, and can be mounted in any position. Complete specifications are available. .....Item 176

VANE RUNNERS. Page 181. Vane runners are now available in continuous coils. Each coil weighs approximately 50 lb and is packed in a box 28 x 28 x 5 in. The vane runner metal emerges from the box at bench height. Catalog and specification sheet are available. .....Item 177

EXHAUST FANS. Page 181. Among the various types of exhaust fans made by this company, is one stack exhaust fan that can be used to convert all types of roof ventilators into exhaust or air supply units. The company also manufactures a remote-drive stack exhaust fan that is designed to handle corrosives or high temperature air, or both. Exhaust fan catalog is available. .....Item 178

HEATING CONTROL. Page 181. A combination timing and thermostatic control automatically starts heating earlier on cold mornings and delays heating on milder mornings. When outside temperatures rise above 65 deg F, the controls stop all heating. The control is fully described in a bulletin. .....Item 179

UNION BONNET GATE VALVES. Page 182. Two-piece union bonnet radial seat gate valves are recommended for general service on steam, water, gas and oil lines where full, unrestricted flow is desired. Valves may be repacked under pressure. Specifications and details are contained in an illustrated brochure. .....Item 180

REFRIGERANT INDICATORS. Page 183. Advance design of these refrigerant indicators, which use a sight glass, keeps refrigerant losses to a minimum. Engineers dealing with fluid flow problems associate the name of these indicators with engineering assistance. A company representative will help in the choice of an indicator. Send for catalog. .....Item 181

FLEXIBLE SLACK-TUBE MANOMETER. Page 182. A convex spring steel scale holds the manometer rigid for use yet permits rolling into a small space for pocket or service kit. Standard ranges are available from 0 to 120 inches in water or mercury. Complete information is available. Item 182

CEILING AIR DIFFUSERS. Page 183. These ceiling air diffusers provide full dimension heating and air conditioning comfort. They are made in five flush and five extended models, sized for 6- to 14-in. ducts with a baked-on metallic finish. Write on letterhead for free literature. .....Item 183

HIGH VELOCITY AIR FILTERS. Page 183. This filter media has special hemmed edges for strength and safe, easy handling. They have a maximum efficiency of 285 to 510 fpm. Low velocity and grease filters are also made. Catalogs available. .....Item 184

OIL UNIT HEATERS. Page 183. An oil-fired unit heater was suspended in each corner of a glass-enclosed swimming pool, overhead and out of the way. The units need no boiler or chimney, and there are no unsightly pipes, valves, and fittings to mar the view. Complete new catalog is available. .....Item 185

STEAM DISTRIBUTING TUBES. Page 185. Trombone-shaped steam distributing tubes provide uniform final temperatures and positive freeze protection for heating and ventilating applications with modulating valve control. Each tube serves two adjacent condensing tubes from a single supply header connection. Publication is available. .....Item 186

MASONRY HAMMER BITS. Page 185. It is a one-man operation to drill hard concrete, granite, or other hard masonry material by using carbide-tipped hammer bits in electric or pneumatic hammers. The bits drill any size hole from ⅜ to 1½-in. diameter. Manual on masonry drilling is available. .....Item 187

STEAM PLANT GAGES. Page 186. Large or small steam generating plants can be controlled by the use of gages that indicate the amount of air furnished to the fire-box; air pressure gages that show windbox pressure; and gages that measure the temperature of flue gases. Information available. .....Item 188

CUTOFF SWITCHES. Page 187. Low draft and low pressure cutoff switches are single purpose switches that monitor positive or negative air pressures. They are adjustable over a wide range and actuate a snap action switch on a fixed differential of 0.02 in. of water. Application information is available. .....Item 189

BOILER WATER FEEDER. Page 188. A boiler water feeder for low pressure space heating steam boilers has ½ in. fittings, copper float, straight-through gate-type drain valve, a cool feed valve, and an enlarged strainer area. Available in capacities up to 5000 sq ft of radiation. Complete catalog literature is available. .....Item 190

INDUSTRIAL UNIT HEATERS. Inside back cover. Bypass dampers control the amounts of air passing through and around the heating coil of these unit heaters. They are available for steam or hot water operation, floor or ceiling installation. Catalog is available. .....Item 191

ROOM THERMOSTATS. Back cover. Ideal temperatures in offices and other comfort areas are maintained by individual room thermostats which regulate the supply of conditioned air from multi-zone air conditioning units. During the heating season, the control automatically varies the heat supply in accordance with outdoor temperature. .....Item 192

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BUSINESS REPLY CARD

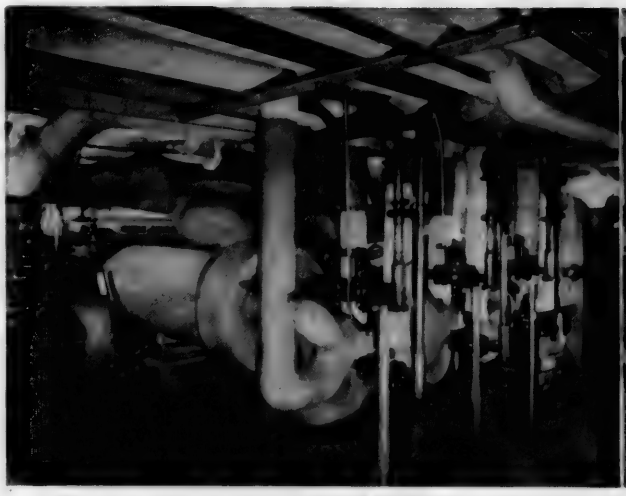
FIRST CLASS PERMIT NO. 36, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

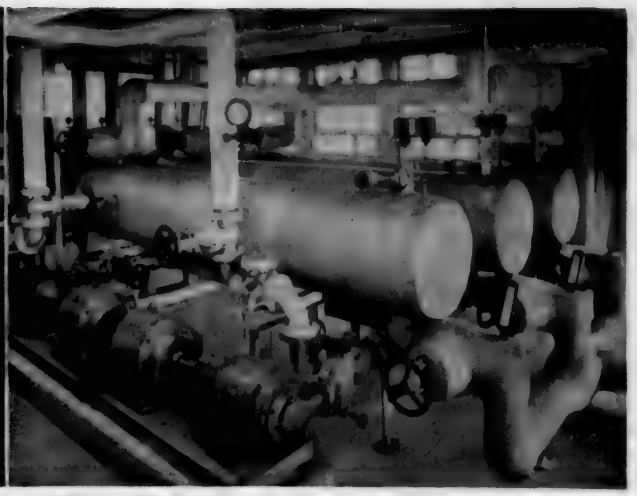
93 WORTH STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE



These three p-k Freon coolers, located in the basement, protrude through brick wall to save space.



Fifth floor installation shown here conditions upper floors. Third floor chillers serve cooling tunnels.

for perfect candy kitchen weather

LOFT'S USES p-k COOLERS

Schwerin Air Conditioning Corp. specified Chrysler Airtemp Units with p-k chillers to keep Loft's 8-story Long Island candy kitchen at just the right temperature and humidity for candy perfection.

You've seen soft, sticky, unappetizing candy you wouldn't want to eat. But you won't see it at Loft's. This big Eastern candy manufacturer has an unusual ability for maintaining the highest standards of quality 'buy-appeal'. And one important reason is its thorough-going air conditioning system employing Chrysler Airtemp units and six p-k dry expansion Freon coolers, engineered and installed by Schwerin Air Conditioning Corp., New York.

At Loft's both humidity and temperature must be rigidly controlled, for when humidity gets out of hand, candy is unsaleable.

So the reheating principle is used to cool the air, and "wring" it to the proper humidity. "Two-circuit" type p-k Freon coolers which chill a glycol solution are located in the basement and the third and fifth floors, to serve nearby areas. Air from conditioned areas passes around coils chilled by the glycol solution and air temperature is reduced some 25°F. to 43°F. A water spray cleans the air, and increases its humidity to 97%. Then the air is circulated around heating coils where its temperature is raised to 60°F. and humidity reduced to 51%—just the right "weather" for perfect candy-making.

The six p-k Freon coolers are automatically controlled; operation is simple. Because the coolers are enclosed, the Loft system is a *clean* system. Compact p-k Freon coolers require minimum floor space, minimum insulation.

If you, like Loft's, have a tough "indoor weather" problem, p-k heat exchange specialists would be glad to assist. More than likely they'll have answers to your particular questions. Write today for illustrated literature and engineering suggestions.

The Patterson-Kelley Co., Inc., 1000 Burson Street, East Stroudsburg, Pa.

PATTERSON-KELLEY

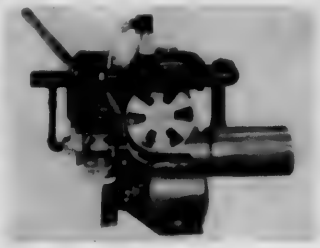
1555

Offices: 101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

(*Continued from page* 152)

Line of 6 Industrial Burners

Industrial gas burners at prices 30 to 40% lower than previous models are offered by Cleaver-Brooks Co., Burner Div., Milwaukee, Wis.



The lower prices apply to six new gas and combination gas and oil burners (Model LG-3 gas burner is illustrated). Their capacities range from 720,000 to 8,600,000 Btu per hr. They can be used for gas alone; for light oil (No. 2 grade) and gas; and a combination of heavy oil (No. 5 grade) and gas.

Secondary air in the burners is furnished by the burner so that it does not have to depend on stack draft. Air is metered in the right quantities to provide correct air to fuel ratios, regardless of whether the burner operates at high or low fire.

Oil and gas interchange is accomplished by the flip of a switch. Air is controlled through a damper modulating between high and low fire.

More information? Circle Item 52 on postcard, page 153.

Condensation Return Unit

A low-pressure condensation return unit for use in steam heating and cleaning systems is being produced by The Deming Co., Salem, Ohio. Operating against pressures up to 20 lb, the condensation unit is rated up to 10,000 sq ft of direct radiation.

Called Hotshot, the vertical unit occupies about two square feet of floor space and requires no underground lines or foundation bolts. The inlet is 7½ in. off the floor. Installation may be made on the floor or in a shallow pit. The unit is 20¾ in. by 19 in. in diameter.

A slotted, compression-type coupling is used for the centrifugal pump. The ⅓-hp motor is capacitor-type with a built-in thermatron and automatic reset for overload protection.

Automatic control is provided by an enclosed, double-pole switch mounted on the receiver and operated by a float. There is no diaphragm or stuffing box.

Bulletin 4958A lists the sizes and capacities of the unit.

More information? Circle Item 53 on postcard, page 153.

Air Curtain Replaces Doors

Two spaces can be separated by means of an air curtain maintained by a system called Sifrag and introduced into the United States by American Air Curtain Corp., St. Louis, Mo.

Free passage can be maintained from one space to another, having either different temperatures, different atmospheric pressures, or a control of odors. In other words, the air curtain acts as an insulating wall penetrable only by solid bodies.

The air curtain is maintained by blowing a suitable quantity of air downwards through directional nozzles installed above a building entrance, thereby producing an air wall. The air is readmitted through a floor grating, cleaned, heated or cooled, and then moved again through ducts back to the nozzles.

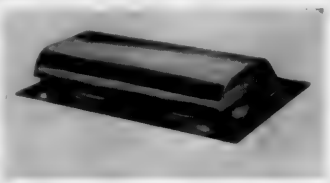
Dust and dirt are removed by filters. Waste paper and small particles that are dropped are collected in a pit under the grating and are periodically flushed by water.

The air wall has a slight velocity that changes either automatically or manually depending upon outside air pressure. Its air velocity under maximum conditions is noticeable, but the company claims it is not more than a soft wind, which would not disturb a lady's hair, for example.

More information? Circle Item 54 on postcard, page 153.

Double Roof Ventilator

A double roof ventilator is announced by Leigh Building Products Div., Air Control Products, Inc., Coopersville, Mich. Designated the No. 410, the unit has a free area of 75 sq. in.



Designed for jobs that require large ventilating areas, the ventilator has two Venturi openings, side by side, in the base of the unit. They are engineered to assure a large volume of air movement.

The roof ventilator is constructed of aluminum with a one-piece base to prevent leaks. A weather baffle prevents leakage from driving rain and blowing snow. An 8-mesh screen keeps birds and insects out.

Bulletin 152-L gives complete information on the new product.

More information? Circle Item 55 on postcard, page 153.

Valve Controls Water Softener

An hydraulically-operated control valve, the Hydromatic, has been designed by Cochrane Corp., Philadelphia, Pa., for use on ion-exchange water softener and demineralizer equipment to provide control of the various steps of operation during regeneration. The valve's design includes a number of internal, diaphragm-operated, individual valves faced with soft rubber to prevent hard water or regenerant from contaminating the treated water.

By turning a small pilot valve and utilizing main line water pressure to operate the diaphragm valves, each step of the cycle is initiated in sequence. Built-in backwash and rinse rate controllers automatically adjust the flow for variations of inlet water pressure.

The valve may be manually operated, or automatically operated by a 40-watt motor sequence control. Motor operation makes the valve adaptable to automatic water conditioning installations.

More information? Circle Item 56 on postcard, page 153.

(*Concluded on page* 160)

SARCO HEATING SPECIALTIES—a complete line

Float Thermostatic Steam Traps

Inverted Bucket Steam Traps

Thermodynamic Steam Traps

Radiator Valves

Radiator Traps

Strainers

Air Eliminaters

Balancing Fittings

Lift Traps

Motor Valves

Temperature Regulators

Water Blenders

Dial Thermometers

Room Thermostats

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for complete lines of

- ★ Heating Specialties
- ★ Finned-Tube and Baseboard Radiation
- ★ Weather-Compensated Control Systems

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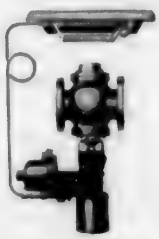
DEPENDABILITY that spells USER SATISFACTION

SARCO CONDENSATE AND VACUUM PUMPS

SARCOTHERM WEATHER-COMPENSATED CONTROL SYSTEMS

Complete Systems Include All Accessory Equipment

Modulating Controls for hot water and radiant heating



Modulating Controls for steam heating

Type AQ Controls for hot water and radiant heating

SARCOfIN

finned-tube and baseboard radiation

4697-B

(*Concluded from page 158*)

Portable Outdoor Heater

A portable outdoor heater that enables contractors to continue work during cold weather is introduced by Master Vibrator Co., Dayton, Ohio.

Designated the Master B-100, the heater weighs 78 lb without fuel and can be lifted or wheeled by one man to wherever it is to be used. In the illustration it is being used on a scaffold.

The heater has a heating capacity of 100,000 Btu per hr and a stainless steel combustion chamber. Its ¼-hp, combination fan and pump motor can move warm air at the rate of 500 cfm.

Operating on 110-115v, 60 cycle, a-c current, the heater burns kerosene, No. 1, or No. 2 fuel oil. It has a 12-hr fuel capacity and automatic ignition that is turned on by a switch.

More information? Circle Item 57 on postcard, page 153.

Larger Pipe Fittings

Injection molded, 3- and 4-in. pipe fittings of unplasticized polyvinyl chloride (PVC) are being marketed by Tube Turns Plastics, Inc., Louisville, Ky. Included are 90- and 45-deg elbows, tees, couplings, and flanges.

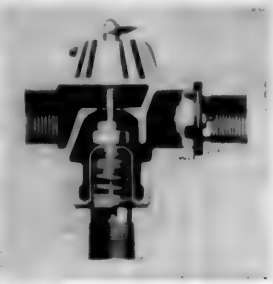
All of the fittings manufactured by the company, from ½ in. up, are available in normal and high impact PVC, and in threaded and socket types, the latter designed for attachment to pipe by solvent or fillet welding.

More information? Circle Item 58 on postcard, page 153.

Valve Tempers Hot Water

A new series, No. 500, hot water tempering valve is placed on the market by Taco Heaters, Inc., Cranston, R. I.

The valve guards against excessively hot domestic water by thermostatically mixing cold water with the hot water as it is drawn from the source. It mixes cold water with hot only while the temperature is above the desired setting. This prevents wasting the available supply of hot water from tankless heaters, storage tanks, or automatic storage water heaters.



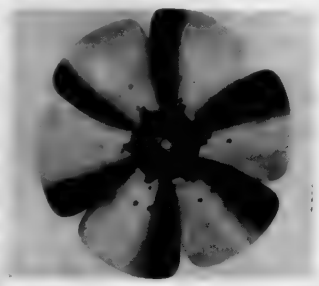
An adaptation of the company's Type A series, the valve utilizes the same hermetically-sealed, thermostatic element which avoids the use of a volatile liquid in a bellows or bi-metal for power. It is powerful enough to crush most obstacles such as specks of dirt and the like.

The valve is adjustable from 115 to 160 deg F and is fitted with two bronze unions to facilitate its installation.

More information? Circle Item 59 on postcard, page 153.

Propeller Fan Blades

A line of propeller fan blades, designed for high air volumes against static resistances, is available in several diameters from Bronson Fan Mfg. Corp., Los Angeles, Calif.



Called the Hi-Static series, the fan blade employs six overlapping blades to give high ratings at reduced fan depth thus enabling them to be used in units where space is limited. Other features are a riveted construction and low noise levels due to blade's ability to overcome higher static resistances at lower speeds.

The fan blades are available with slinger-rings for condenser applications.

More information? Circle Item 60 on postcard, page 153.

Line of Steam Traps

A line of inverted bucket-type steam traps is announced by The Clark Mfg. Co., Cleveland, Ohio.

Called Thrifttraps, the units are available for pressures to 250 psi and temperatures ot 450 deg F. They may be furnished with horizontal or vertical inlet and outlet connections of ½ or ¾-in.

Specifications and discharge capacities are available upon request.

More information? Circle Item 61 on postcard, page 153.

Hand Truck for Appliances

A stair climbing hand truck, which is intended to reduce the work involved in delivering appliances, is announced by Valley Craft Products, Inc., Lake City, Minn.

Designated Stair Cart Model 400, the hand truck is equipped with a ratchet mechanism that enables it to roll up stairs step by step as the operator pulls a drive cable. Two wheel safety brakes in the truck allow the operator to control the load in order to avoid serious accidents when descending stairs or ramps.

A belt reel that can be adjusted to the height of the load is another feature of the truck. The belt is tightened by a ratchet wheel and can be wrapped around loads both vertically and horizontally. A single operator can tip loads because of an arrangement that allows the shoe to slide out from the frame and change the fulcrum.

Other features include skid rails to facilitate loading trucks, a padded frame to eliminate scratching appliances, and aluminum construction for lighter weight. The truck is equipped with pneumatic tires to simplify the movement of heavy loads over rough terrain and to prevent marking steps and floors.

More information? Circle Item 62 on postcard, page 153.

CONCEAL-X

THE NEW AIR CONDITIONING UNIT THAT REQUIRES NO FLOOR SPACE

for

MOTELS
HOTELS
HOMES
OFFICES
HOSPITALS
and
General Buildings

Conceal-X is built to save you money, make you money, and to better satisfy your customer. It is a real space saver designed for use in out of the way places and with the capacity to do a big job *quietly*. Recommended for motels, dwellings and buildings for Winter-Summer air conditioning. Conceal-X, installed in vestibules, overhead entrance ways, plenums, closets or hallways with or without false or furred ceilings, provides horizontal discharge to one or several adjacent rooms. Best of all, Conceal-X incorporates the Peerless patent-applied-for Hi-F finned construction that gives you greater B.T.U. efficiency year after year. May we send you bulletin and specifications?

PEERLESS OF AMERICA, INC.

MANUFACTURERS OF REFRIGERATION AND AIR CONDITIONING COILS SINCE 1912

Dept. A, 6550 N. PULASKI ROAD, CHICAGO 30, ILL., U.S.A.

NEWS OF THE MONTH

WATER POLLUTION CONTROL

advanced by state plans for legislation regulating stream contamination by cities and industries.

New or more stringent laws to curb water pollution from municipal sewage and industrial wastes were enacted this year in Arkansas, California, Colorado, Florida, Montana, North Carolina, Oklahoma, Tennessee, Texas and Washington.

Bills to facilitate local borrowing to finance the construction of sewage treatment facilities were also enacted in a number of states, including Illinois, Indiana, Maryland, Michigan, New York, North Carolina, Tennessee and Washington.

A measure to appropriate funds for continuation of program of state aid to municipalities for the construction of sewage treatment plants is pending in Pennsylvania, while a proposal for the inauguration of such a program in Connecticut was rejected.

New Hampshire has a new law permitting tax exemptions to industries cooperating in water or air pollution abatement.

A summarization of these and other current-year legislative developments in the water pollution control field, as reported from state capitals throughout the country, follows:

• **ARKANSAS.**—After being inactive since 1953, the Arkansas Water Pollution Control Commission got an appropriation of $30,800 a year from the 1955 state legislature for revival of its stream-cleaning program.

Glen T. Kellogg, chief sanitary engineer of the State Health Department, who will head the commission's activities, pointed out it would take some time to organize a permanent staff to get the program back into full swing. There also were some legal questions to clear up concerning the commission's membership.

The funds provided by the legislature will permit hiring of a staff to include an engineer-director, a field engineer, chemist, secretary and two aquatic biologists.

• **CALIFORNIA.**—Legislature strengthened the state's water pollution control law by authorizing the State Water Pollution Control Board to take action to correct existing or threatened pollution of nuisance if a regional board failed to act.

The new act also empowers the state board to direct that action to correct such a condition be taken by any other state agency having jurisdiction.

• **COLORADO.**—Legislature enacted strict pollution controls to curb dumping of sewage into streams, and provided that district courts could exercise contempt powers whenever an individual or community was found in violation of pollution laws and failed to correct the condition. The State Board of Health will administer the new restrictions.

• **CONNECTICUT.**—Rejected by the Connecticut legislature was a bill which would have restricted the powers of the State Water Commission to order municipalities to install sewage treatment plants to eliminate pollution.

Also failing of enactment was a bill to have the state assume part of the cost of constructing local sewage treatment facilities.

• **FLORIDA.**—Bills enacted by the Florida legislature included an appropriation of $48,000 for a study of the state's water resources, including water pollution problems.

Also enacted were measures designed to curb dumping of wastes into the Peace, Alafua and Withlacoochee rivers.

• **GEORGIA.**—Failing of enactment in the Georgia legislature was a bill to limit the amount of chemical solution, industrial waste, garbage, sewage or other substances that may be deposited in streams to that amount which streams can absorb without killing fish or endangering health or persons.

• **ILLINOIS.**—Legislature enacted measure permitting the use of sewer revenue bonds to pay for sewage works improvement other than sewers only, and to permit the sale or lease of township sewage works.

Also enacted was a bill creating a sewer system investigation commission to study the problems of integrating sewer systems maintained by bordering cities and sanitary districts.

• **INDIANA.**—Bills enacted by the Indiana legislature included a measure increasing the bonding limit of the Indianapolis Sanitary District from 4 to 6%. The legislation was designed to clear the way for financing some $14,000,000 of sewer construction and sanitation plant improvements.

• **MAINE.**—Rejected all proposals for more stringent laws to curb water pollution from municipal sewage and industrial wastes.

• **MARYLAND.**—After hearing state health officials and sanitary engineers from several communities suggest that state aid to local subdivisions might be required to solve the water pollution problem, members of the ways and means committee of the Maryland House of Representatives favored an interim study of the state assistance principle.

Other action by Maryland lawmakers included enactment of a measure authorizing a Baltimore city referendum on a $7,500,000 bond issue for improvement to the city's sewer system.

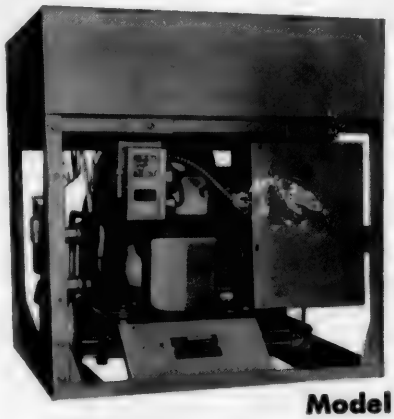
• **MASSACHUSETTS.**—Rejected by the Massacusetts legislature was a bill which would have suspended the powers of the State Public Health Department in attempting to curb pollution in the Connecticut River Valley.

The measure was turned down after heated discussion from representatives of communities along the rivers which would be required by state health department orders to build sewage treatment plants which may cost a total of close to $20,000,000.

• **MICHIGAN.**—Legislature enacted a bill which will allow two or more municipalities to incorporate an authority for the operation of sewage disposal and water supply systems.

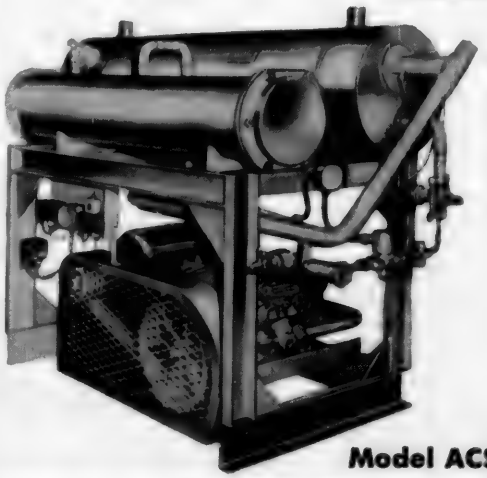
(*Continued on page* 164)

Now...a complete line of packaged AMERICAN-Standard Water Chillers for all types of buildings



Model PAS

Model PAS-AC



Model ACS

American-Standard now offers a complete line of quality air-cooled and water-cooled chillers for all air conditioning requirements. These packaged chillers are factory assembled with circuits piped, wired and tested for fast, low-cost installation. All are compactly designed and mounted in a rigid steel frame for easy handling—all have matched components to provide outstanding operating efficiency and economy.

Model PAS . . .

for homes and small commercial buildings. This compact American-Standard Water Chiller is available in 2 and 3 hp sizes. It has a hermetically sealed motor and compressor assembly which carries a 5-year warranty. An attractive 20-gauge steel cabinet is available for the chiller. Both Models PAS and PAS-AC are shipped with an operating charge of Freon 22, eliminating the time and expense of separate system charging.

Model PAS-AC . . .

Now, a packaged water chiller with air-cooled condenser. This unit is ideal for use in homes and small commercial buildings in areas where a scarcity of water exists. This factory-assembled, hermetically sealed water chiller, equipped with a compact air-cooled condenser is available in 2 and 3 hp packaged units. It needs no separate water supply for condenser cooling.

Model ACS . . .

for medium and large sized buildings. Large American-Standard Water Chillers range in size from 7.5 up to 75 hp. They feature low-speed compressors for extra quiet operation. These units are delivered completely assembled; make a few simple piping and electrical connections and this large-capacity chiller is ready to go.

. . . . . .

For more information on complete Remotaire Heating-Cooling Systems—chillers, room conditioners and boilers—write to the Plumbing and Heating Division, American Radiator & Standard Sanitary Corp., P. O. Box 1226, Pittsburgh 30, Pennsylvania.

AMERICAN-Standard

WATER HEATING-COOLING SYSTEMS

WATER POLLUTION CONTROL

(*Continued from page* 162)

• **MONTANA.**—A bill providing for the creation of a new seven-member State Water Pollution Council, to control, prevent and abate pollution of surface and underground waters, was enacted by the Montana legislature.

Members of the council, under the bill, include the State Board of Health's executive officer, the state fish and game warden, the state engineer and four members named by the governor. It was specified that the latter include one representative each from industry concerned with disposal of organic waste, agriculture and municipal government.

The act declares that "no waters not now being used for human consumption as a single public supply system serving more than 100 persons shall be classified other than for industrial waste where the same has been primarily and continuously devoted to industrial waste except for seasonal variations for a period over 30 years."

Administration of the new law was placed in the hands of the State Board of Health, under supervision of the council. The health board subsequently indicated, however, that because of its limited funds it might not be able to immediately provide staff or services to the new council.

• **NEBRASKA.**—Killed in the Nebraska legislature was a bill proposing creation of a State Water Pollution Control Agency. Opposition to the measure had been expressed by spokesmen for the sugar beet industry in western Nebraska, the packing industry at Omaha and the League of Municipalities.

• **NEW HAMPSHIRE.**—Legislature enacted a bill to extend tax exemptions to industries that cooperate in installation of facilities to reduce water or air pollution.

• **NEW YORK.**—A measure approved by New York lawmakers for submission to the electorate in November would allow the legislature to permit cities to issue bonds for construction of sewage disposal or drainage facilities in cases where such installations will also be used to provide service, on a contract basis, to neighboring communities as is now permitted with water facilities.

Also referred to the New York electorate was the question of whether indebtedness for sewage disposal and drainage facilities should be exempted in figuring municipal debt limits.

• **NORTH CAROLINA.**—Legislature put teeth in the North Carolina stream pollution abatement law by requiring municipalities to use every means at their disposal to curb pollution when ordered to do so by the State Stream Sanitation Committee.

Under the law previously in effect, if the committee ordered industries and towns along a stretch of stream to abate pollution none had to comply, and neither did industries, if one of the towns said it was financially unable to abate its pollution.

The new law requires that municipalities issue revenue bonds to finance waste treatment plants even when the voters turn down a general obligation bond issue for that purpose. Municipalities will be excused only when financially unable to issue revenue bonds, which would be paid off with sewer charges against residents.

Also enacted by the North Carolina lawmakers was a bill to enable two or more counties or cities to cooperate in the financing and construction of sewer and water facilities.

Another legislative enactment fixed a deadline of Jan. 1, 1960, for the end of dumping raw sewerage into the Haw River and its tributaries by the city of Greensboro and a number of other cities and towns.

• **OKLAHOMA.**—Legislature enacted a bill giving the State Corporation Commission jurisdiction in pollution by oil well drilling, development, producing and refining.

• **PENNSYLVANIA.**—Still pending in the Pennsylvania legislature at this writing is a bill to appropriate $2,600,000 to continue payments to municipalities of up to 2 per cent of the cost of sewage treatment facilities built locally to comply with the state's clean stream law.

As started originally in 1953 the payments go only for facilities built since 1937. A State Senate committee, however, amended the bill to date the eligibility period back to 1920.

• **TENNESSEE.**—Legislature enacted a bill authorizing the state to join in the Tennessee River Basin water pollution control pact with other states through which the Tennessee River and its tributaries flow.

Another legislative enactment permits cities to pledge public utility revenues, not otherwise pledged, to the retirement of sewer bonds.

• **TEXAS.**—Bills enacted by the Texas legislature included a measure directing the State General Land Office to enforce the anti-pollution laws on geophysical shooting and drilling of oil in the Gulf of Mexico. The State Game and Fish Commission previously held the duty.

Also enacted was a bill allowing the State Railroad Commission to require bond of oil drillers to insure against water pollution.

• **WASHINGTON.**—Legislature strengthened the state's pollution control laws by providing that commercial or industrial firms must obtain a permit from the State Pollution Control Commission before disposing of solid or liquid waste material into lakes, streams or salt water.

The commission was empowered to specify conditions for disposal of waste to avoid unnecessary pollution.

Also enacted was a bill to permit municipalities to issue utility bonds for construction of sewage and disposal systems.

SOLID FUELS CONFERENCE

to hear papers on coal reserves, utilization and handling technology with emphasis on future.

The technical program has been announced for the 1955 AIME-ASME Joint Solid Fuels Conference, to be held at the Neil House in Columbus, Ohio, on October 19-21.

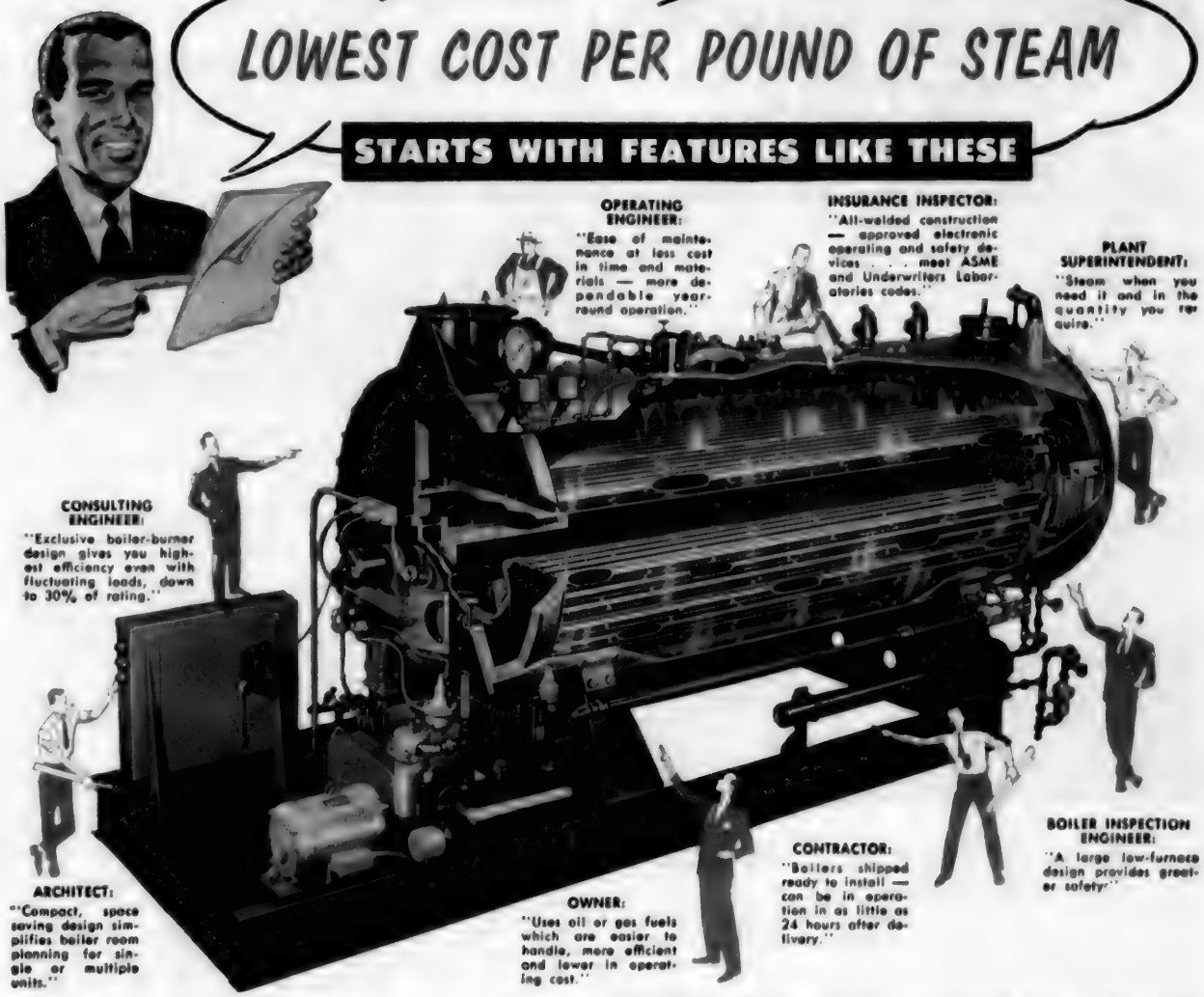
Keynote of this national conference will be the Future of Solid Fuels, which has brightened with the remarkable rise of coal production this year after seven years of declining markets.

• **PROGRAM.**—The program includes the following papers:

(*Continued on page* 166)

LOWEST COST PER POUND OF STEAM

STARTS WITH FEATURES LIKE THESE


OPERATING ENGINEER:
"Ease of maintenance at less cost in time and materials — more dependable year-round operation."
INSURANCE INSPECTOR:
"All-welded construction — approved electronic operating and safety devices . . . meet ASME and Underwriters Laboratories codes."
PLANT SUPERINTENDENT:
"Steam when you need it and in the quantity you require."
CONSULTING ENGINEER:
"Exclusive boiler-burner design gives you highest efficiency even with fluctuating loads, down to 30% of rating."
ARCHITECT:
"Compact, space saving design simplifies boiler room planning for single or multiple units."
OWNER:
"Uses oil or gas fuels which are easier to handle, more efficient and lower in operating cost."
CONTRACTOR:
"Boilers shipped ready to install — can be in operation in as little as 24 hours after delivery."
BOILER INSPECTION ENGINEER:
"A large low-furnace design provides greater safety."

that's why you profit most from Cleaver-Brooks self-contained boilers

● Top to bottom, inside and out, you get more money-saving features when you specify or buy Cleaver-Brooks self-contained boilers. You make an *investment in quality* that pays off in lowest net cost per pound of steam for processing or heating.

YOU BENEFIT from more than 20 years of experience, working closely with men who have made it their business to be *right* about boilers. You profit from complete coordination throughout planning, installing, supervising and final operation.

YOU BENEFIT from self-contained design and original four-pass construction. These Cleaver-Brooks engineered "firsts," plus forced draft, 5 sq. ft. of heating surface per boiler hp, and exclusive burners, all contribute to highest heat transfer. Guaranteed 80% thermal efficiency when firing with oil is the direct result!

Whether you're planning a new steam plant or modernizing, make certain you get the complete Cleaver-Brooks story before you buy. See your Cleaver-Brooks representative or write for catalog AD-100. Cleaver Brooks Company, Dept. L, 315 E. Keefe Ave., Milwaukee 12, Wisconsin, U.S.A. *Cable Address CLEBRO — Milwaukee — All Codes.*

One typical owner can count on yearly savings ($15,000 fuel and $10,000 labor) from this battery of three 150 hp Cleaver-Brooks self-contained boilers.

●

SEE OUR EXHIBIT — Chicago Exposition of Power and Mechanical Engineering — November, 1955

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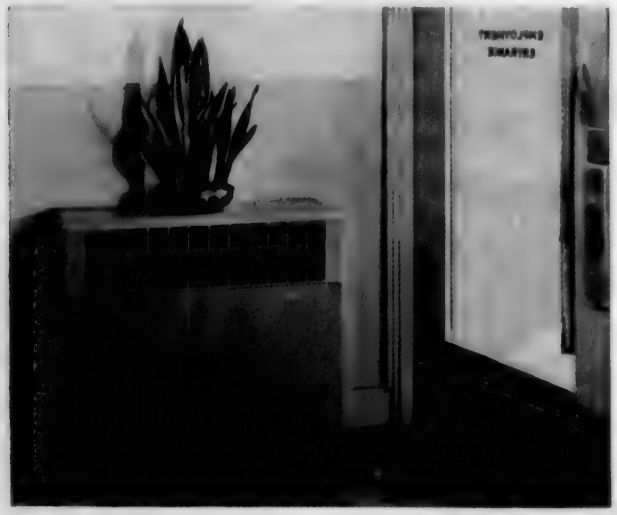
Cleaver Brooks

ORIGINATORS OF THE SELF-CONTAINED BOILER

BOILERS . . . STEAM OR HOT WATER . . . FOR HEATING OR PROCESSING, IN SIZES FROM 15 TO 500 hp, 15 to 250 PSI.

Carrier knows heating

Over fifty years of leadership in air conditioning have given Carrier unmatched experience in the control of temperature—heating as well as cooling. Yes, Carrier knows heating by experience . . . and all this engineering skill and leadership contributes to the superiority of Carrier Unit Heaters.



CARRIER CABINET UNIT HEATERS

Cold reception rooms, lobbies, vestibules, entrances are poor invitations to patrons of banks, hotels, stores, restaurants or similar commercial establishments. Owners will never know how much business they lose as a result. But the cost of a Carrier Cabinet Unit Heater is so little in comparison that the installation becomes a matter of good business.

Carrier floor, ceiling and semi-recessed wall models are suitable for both steam and hot water. Every unit has many unmatched features such as quiet blower assembly, directional air louvers, long-lasting non-ferrous tubes and fins, functional design for easy installation, and attractive styling and finish.

Recessed model

WRITE OR MAIL COUPON for model sizes, feature story and selection data

Carrier

air conditioning
refrigeration
industrial heating

CARRIER CORPORATION
306 S. Geddes St., Syracuse, New York
Send folder on Carrier Cabinet Unit Heaters.

Name_____

Business_____

Address_____

SOLID FUELS CONFERENCE

(Continued from page 164)

Coal Reserves of the U. S. for Future Use, by Clayton G. Ball, President, Paul Weir Co., Chicago, Ill.

Opportunities for the Fuel Technologist in the Coal Industry, by T. S. Spicer, Professor, Fuel Technology, Pennsylvania State University, University Park, Pa.

Future Trends in Stoker Design, by Earle C. Miller, Research Engineer, Riley Stoker Corp., Worcester, Mass.

Trends in Coal Handling for Electric Power Stations, illustrated with the motion picture "From Mine to Plant," by Howard E. Nelson, Manager, Conveyor Engineering, The Jeffrey Mfg. Co., Columbus, Ohio.

Trend of Future Coal Washers, by J. A. Glunt, Steel Works Metallurgist, and J. R. Dawson, Chief Chemist, Jones & Laughlin Steel Corp.

Lignite as a Future Fuel for Steam Generation, by R. L. Sutherland, Research Consultant, Truax-Traer Coal Co., Chicago, Ill.

Future of Synthetic Liquid and Gaseous Fuels, by H. R. Batchelder, Consulting Chemical Engineer, and Harlan W. Nelson, Chief, Fuels Technology Division, Battelle Memorial Institute, Columbus, Ohio.

Effect of Fly Ash Utilization on the Future of Solid Fuels, by H. H. Russell, Project Engineer, Bituminous Coal Research, Inc., Pittsburgh, Pa.

A number of other technical papers will round out the picture of the future which is in store for solid fuels. In addition to the technical program, participants will hear addresses by well-known figures in solid-fuels fields.

The Solid Fuels Conference is sponsored jointly by the American Institute of Mining and Metallurgical Engineers and by the American Society of Mechanical Engineers. More than 250 engineers are expected to attend.

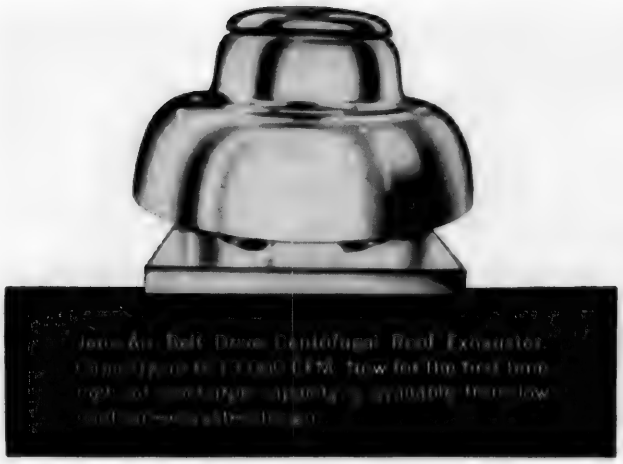
Elmer R. Kaiser, director of research, The American Society of Heating and Air Conditioning Engineers, is chairman of the Conference. Co-chairman is William T. Reid, of the administrative staff of Battelle Memorial Institute. The technical program was arranged by Theodore R. Jolley, Charles H. Marks, and Charles H. Sawyer, representing the sponsoring societies.

Back Issues of the Guide Wanted for Students

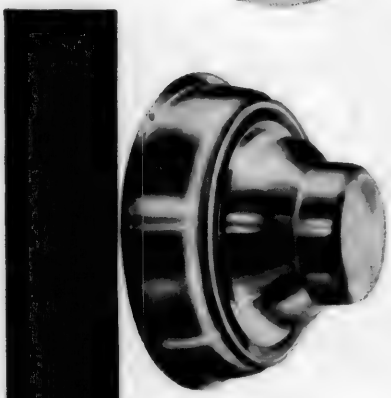
Students in heating, ventilating and air conditioning courses find that even a back issue of the ASHAE *Guide* is a valuable reference book for school work.

Professor Frederick B. Morse of Purdue University writes that he needs additional *Guides* for prospective new members of the Student Branch this fall; so if any readers have a 1950 (or later) issue that is just collecting dust on their book shelves, why not let an engineering student have it?

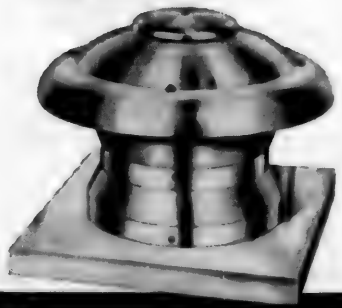
Send your old *Guides* to: Frederick B. Morse, ASHAE Faculty Adviser, School of Mechanical Engineering, Purdue University, Lafayette, Indiana.



Jenn-Air Belt Drive Centrifugal Roof Exhauster. Completely redesigned CFM. Now for the first time ... [illegible]



Wall Exhausters—architecturally sculptured button design—spots ventilation control



Low Contour Roof Exhausters blend with [illegible]

WHY is a Jenn-Air versatile

There's one word that sums up the scores of advantages offered by Jenn-Air Exhausters . . . it is "versatile."

VERSATILE—because Jenn-Air exclusive low contour design means adaptability to modern architectural structures—neat appearance—no unsightly intrusion to roof line.

VERSATILE—because Jenn Air offers dual ventilation with a unit for every need; wall exhausters if the area to ventilate is flush to an outside wall . . . roof exhausters for heavy air load movement.

VERSATILE—because Jenn-Air saves on costs with short ducts for wall installations. No platforms, louvres or penthouses necessary for roof installation.

VERSATILE—because service cost is cut—simplified design using nationally known motors—grease packed—full ball bearing—designed for 10 years service without regreasing—easiest of all to disassemble and clean.

VERSATILE—because a nationwide network of sales engineering offices stands ready to serve you no matter what your need—from a small replacement part to counsel on a major installation.

JENN-AIR PRODUCTS COMPANY, INC.

Architects & Building Building ● Indianapolis 4, Indiana

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Please rush me Catalogs 53-B and 55-A.

Name _____

Company _____

Address _____

City _____ State _____

SEAWOLF

launched for atomic power test run, features air conditioning and odor control.

Heating, ventilating and air conditioning were of particular interest in an event that took place July 21, at Groton, Connecticut: The Seawolf, world's second atomic-powered submarine slid down the ways at the Electric Boat Division of the General Dynamics Corp. The Seawolf contains not only engineering triumphs in the new field of nuclear propulsion, but the most ultra-modern ventilating, air conditioning and odor removal system yet incorporated into submarine design.

Launching the Seawolf.

With the champagne blessing of Mrs. W. Sterling Cole, wife of the Congressman from New York, on her bow, the eyes of the military world will be scrutinizing the Seawolf's performance, and comparing it with the performance of her sister-sub, Nautilus. But one thing is agreed upon—her capabilities will, in the main, be limited only by the human factors involved—the ability of her crew to endure the close quarters for extended periods.

• **AIR CONDITIONING.**—Ventilating and air conditioning are important keys to performance of the Nautilus and Seawolf. As the Navy put it: "Because they will be capable of prolonged submerged operation, special provisions for conditioning and revitalizing the atmosphere inside the submarine are incorporated in their design. This is being done in order that the endurance of the crew will also be greatly extended."

• **ODOR CONTROL.**—Among these special provisions are odor absorbers of activated, coconut-shell charcoal, supplied for both the Nautilus and the Seawolf by the Barnebey-Cheney Company of Columbus, Ohio.

The main purpose of these absorber-filters is to remove odors, purify and freshen the air within the undersea craft. A large-capacity air conditioning system will keep the inside of the Seawolf comfortably cool, despite the intense heat generated by the nuclear power plant. The reactor will provide enough surplus energy to run this system also.

(*Continued on page* 170)

CLEAN AIR ELECTRONICALLY

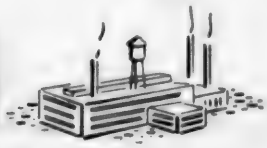
THE Electro-STAYNEW WAY

• Eliminate SMOKE, AIRBORNE DUST, POLLEN

IN ALL TYPES OF VENTILATING SYSTEMS

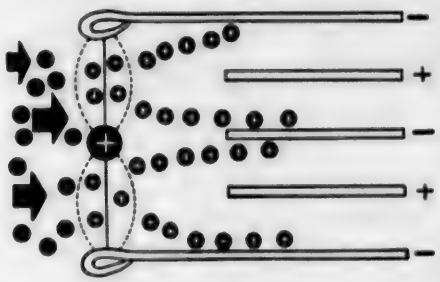
WITH Electro-STAYNEW PRECIPITATORS

for INDUSTRY



Give your plant tested, economical clean air protection.

Based upon the principle of "electrostatic precipitation," the Electro-Staynew Precipitator charges the dust particles positively (+) as they enter the unit. The particles are then attracted to and held by the negatively (−) charged collector plates as shown in the diagram below.



By this method, the Electro-Staynew removes dust, smoke, soot, and microscopic particles (as small as 1/250,000 of an inch in diameter) from the air with higher efficiency and lower maintenance cost than is possible with any other type of filter. In addition, this new Electro-Staynew Precipitator has unit construction—ionizing and collecting chambers are in one compact unit.

The simple unit construction of the Electro-Staynew gives it unusual flexibility. Combinations of the two basic cell sizes make possible complete installations of any desired capacity. This feature saves time in assembly and simplifies installation. The lightweight construction permits overhead mounting where necessary.

The Electro-Staynew Precipitator can improve the efficiency of your workers, the quality-control of your products; and its extremely low maintenance cost makes operation economical.

AFI MEMBER AIR FILTER INSTITUTE

Write for Bulletin 400

for complete information

DOLLINGER PRECIPITATOR ELECTRO STAYNEW

DOLLINGER CORPORATION 15 Centre Park • Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

THE BEAUTIFUL NEW *Airtherm*
cabinet unit heater

COMBINES
22 INDUSTRY APPROVED
PERFORMANCE PROVED
22 FEATURES

A thorough engineering research preceded the manufacture of Airtherm Cabinet Unit Heaters. Alternative features and designs were analyzed from the standpoint of proved practicality and efficiency.

We believe the 22 features emerging from this screening are the best in the industry for this type design.

They are your assurance of top efficiency, installation versatility, and dependable performance through the years.

MAIL COUPON FOR COMPLETE DATA

Airtherm Manufacturing Co. Dept. B.
700 S. Spring
St. Louis 10, Missouri

Gentlemen:

Please send complete information on Airtherm Cabinet Unit Heaters.

Name_____

Street_____

City_____ State_____

SEAWOLF

(*Continued from page* 168)

All of the ship's air is passed through the charcoal filters by this air conditioning system, the charcoal removing odors and certain gases.

In addition, special charcoal filters were built by Barneby-Cheney for vent pipes of the waste tanks from the galley and head. These tanks, into which waste from the kitchen and lavatories is dumped, must be vented within the sub itself. The special charcoal filters remove odors and certain gases from these tank vents. All water closets on the sub are also equipped with small charcoal fresheners to remove another source of odor aboard.

NOISE

to be subject of research at ASHAE lab in move to develop new standard of measurement.

A new study of noise from air conditioning equipment and installations will be started this fall by the ASHAE Research Laboratory.

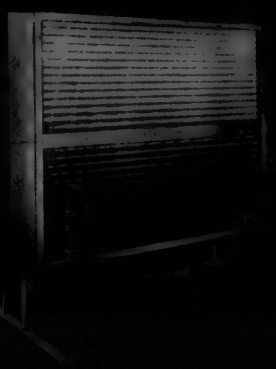
This announcement was made by Elmer R. Kaiser, ASHAE Director of Research, Cleveland, Ohio, following the endorsement of the plans by the National Association of Fan Manufacturers and the Industrial Unit Heater Association. Both of the endorsing organizations have their headquarters in Detroit, Michigan.

• **OBJECTIVE.**—The immediate objective of this project, according to Mr. Kaiser, is the development of a basic method of sound measurement which can be adopted as a standard so that this noise control can be organized on an engineering basis. The need for this sound "yardstick" has been apparent to acoustics experts and air conditioning engineers for several years. Financial support for the program is now being encouraged from individual companies manufacturing fans, blowers, motors, compressors, air conditioner units and other component parts such as ducts, fittings, and grilles.

"All measurements of noise level, even by different operators, should be on a comparable basis," said Mr. Kaiser. "Furthermore, the noise level scale should be related to loudness as noted by the human ear. Decibel readings alone are inadequate because they indicate only sound pressure. Loudness is also a function of sound frequency or pitch. A practical measuring technique must combine the sound energies produced at different frequencies. A complication calling for a number of determinations on, say, a fan is the variation in noise emission in different directions."

• **TAC.**—The Technical Advisory Committee on Sound and Vibration Control of the American Society of Heating and Air-Conditioning Engineers is under the chairmanship of Harold A. Lockhart of Chicago. This Committee has carefully assembled and screened numerous technical suggestions in organizing the program. In addition to the measuring technique, the program seeks to determine the attenuation of sound in ducts, and the regeneration of noise by turbulence in duct fittings and dampers.

STOP *using water!*



Eliminate all water problems with UNICON by KRAMER. Any size compressor, regardless of tonnage, can be air-cooled with UNICON.

KRAMER **UNICON**

Stands, hoods, and wind deflectors are available for simplified outside mounting
You need nothing else!

WRITE FOR BULLETIN U-210C

KRAMER TRENTON CO. • Trenton 5, N.J.

the man on the job can tell you...

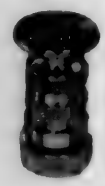
it pays to figure on

ALLENCO

INTERIOR FIRE-PROTECTION

"Allenco makes everything that might be called for in standpipe-type fire protection. Their prices and deliveries are reliable. Some of their items actually cut installation costs. Never had any trouble with them, and they're bringing out new things all the time."

√ figure next job with ALLENCO



Established 1887

W. D. ALLEN MANUFACTURING CO.

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25 Sales Offices • New York 7

NEW CATALOGS

Use the prepaid postcard on page 153 for securing your copies of catalogs described in this department.

PYROMETER SERVICE TIPS—A bulletin, F 7259, published by Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill., gives service tips for pyrometer users. Some of the important tips covered by the bulletin are: what to do if instrument is reading erratically; instrument temperature curve off; instrument reading too high; instrument reading too low; and instrument controls erratically. ----**Item 63**

REPORT ON ICE SKATING RINKS—Ice Skating Rinks — Their Construction and Maintenance is the title of an illustrated, 32-page report published by A. M Byers Co., Pittsburgh, Pa. Prepared for architects, engineers, arena superintendents, rink owners and municipal officials, the brochure contains a brief foreword, a conclusion and eight major sections listed under individual subject headings. Sections include discussions of corrosion and corrosion control, types of rink construction, comparative service record data, case history digests of rink installations, recommended maintenance procedures, and brine tables. ----------**Item 64**

FIRE EQUIPMENT FILE—Several new convenience features are contained in the current AIA file 29e2 issued on Allenco fire protection equipment by W. D. Allen Mfg. Co., Chicago, Ill. Descriptions include photos, drawings, and references to fire regulations of major cities. The file unit contains specifications with blanks for alternatives involved in each type of cabinet. The user may copy the standard descriptions, with appropriately filled blanks, for specification sheets. ----------**Item 65**

COOLING EQUIPMENT BULLETIN—A 4-page, 2-color bulletin, No. 4001, offered by Patterson-Kelley Co., Inc., East Stroudsburg, Pa., describes and illustrates the company's line of special and standard air conditioning and refrigeration equipment. The bulletin gives descriptions of dry expansion Freon and storage coolers, condensers, and the company's patented slug eliminator and balance loader. Eleven photographs and five piping diagrams are included in the bulletin. ----------**Item 66**

AIR POLLUTION CONTROL—Air pollution and its control through the application of activated carbon is the subject of a technical bulletin, designated E-21, available from Barnebey-Cheney Co., Columbus, Ohio. The bulletin lists and describes the various types of atmospheric contaminants and ten types of treatment to eliminate or reduce contaminants in industrial exhaust gases. Explained in greater detail is the use of Adsorbite activated carbon to eliminate polluting gases by adsorption. ----------**Item 67**

HEATING TRADE CATALOG—A 168-page catalog, No. 19, is being distributed to the heating trade by A. R. Webber Co., Inc., New Haven, Conn. The catalog includes lists of tools, equipment, parts, supplies, and accessories. It also includes parts and equipment for the air conditioning trade. ----------**Item 68**

(*Continued on page* 174)

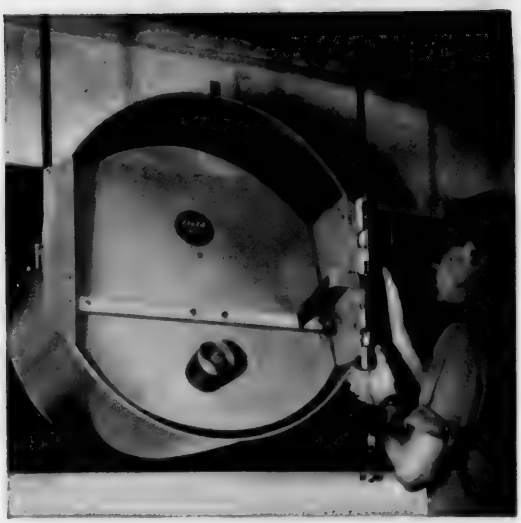
DEPENDABLE,

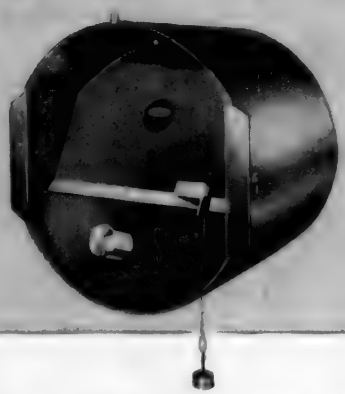
PRECISELY ACCURATE

Draft Control

for coal fired, oil fired, gas fired or gas-oil fired

HEATING PLANTS





FIELD TYPE "M" for coal and oil fired heating plants

Heavy duty commercial model in 28" and 32" sizes. Heavy, rigid construction assures long, trouble free service. Stainless steel knife edge bearing for permanent sensitivity. Also available in 6" through 24" sizes for domestic and commercial installations. First choice of heating men — the round control you can level on any flue.

FIELD TYPE "MG" for gas and gas-oil fired heating plants

A heavy duty, precision built control in sizes 8" through 32" for commercial and industrial installations. Stainless steel knife edge bearings for permanent sensitivity. Gate opens inward to regulate updrafts, and outward to relieve down-drafts. Optional safety switch available where codes require. Fully proven, accepted virtually everywhere.

They're real HEAVYWEIGHTS

Compare the weight of a Field Control to any other available. Here is proof of the massive, welded construction, long, vibration-free service, that permits Field's supreme accuracy.

Size Control	Gate	Thickness of Parts Side Plates	Ring	Collar	Wt. without Crtn. or Crate
14 M	16 Ga.	16 Ga.	⅜ x 2"	22 Ga. Galv.	19 #
16 M&MG	16 Ga.	16 Ga.	⅜ x 2"	18 Ga. Galv.	28 #
18 M	16 Ga.	16 Ga.	⅜ x 2"	18 Ga. Galv.	35 #
20 M&MG	16 Ga.	16 Ga.	½ x 2"	18 Ga. Galv.	41 #
24 M&MG	14 Ga.	16 Ga.	½ x 2"	18 Ga. Galv.	65 #
28 M&MG	14 Ga.	14 Ga.	¾ x 4"	14 Ga. H.R.S.	110 #
32 M&MG	14 Ga.	14 Ga.	¾ x 4"	14 Ga. H.R.S.	140 #

field

FIELD CONTROL DIVISION

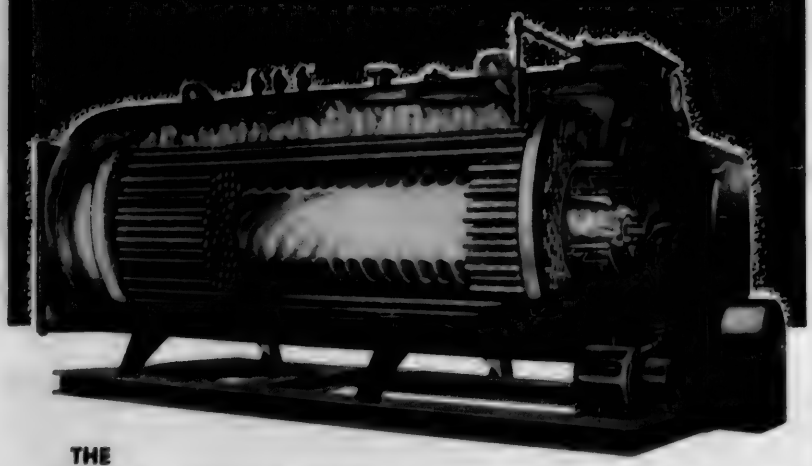
of H. D. CONKEY & COMPANY, Mendota, Ill.

Affiliates

Conco Building Products, Inc. • Brick, Tile, Stone

Conco Materials Handling Division • Cranes, Hoists

GET YOUR
STEAM and HOT WATER
FROM A LOW COST PRODUCER!



THE
Continental AUTOMATIC BOILER

- generates the steam and hot water you need at low fuel cost and with little maintenance.
- is highly efficient—over 80% guaranteed—due to its unique "spinning gas technique".
- can be opened for cleaning or inspection by one man in less than ½ hour, for it has hinged doors at both ends.
- distributes heat evenly to the rear tube-sheet and all return tubes. This results in balanced water circulation and uniform longitudinal expansion of the entire pressure vessel.
- has long service life because of free, rapid water circulation, uniform heat transfer, simplicity of construction and quality workmanship.

Fully automatic, Continental Boilers are used for hot water and high or low pressure steam applications. Units range from 20 to 500 hp and can be gas, oil or combination fired.

Write for catalog and the name of your nearest distributor. Let us bid on the next boiler you need.

Send for all the facts on the Continental Automatic Boiler.

Continental AUTOMATIC BOILERS

BOILER ENGINEERING and Supply Company, Inc.

7 Manavon St. • PHOENIXVILLE, PA. • Phone 5832

NEW CATALOGS

(*Continued from page* 172)

Use the prepaid postcard on page 153 for securing your copies of catalogs described in this department.

MASONRY PRESERVATION—A 16-page brochure entitled Masonry Preservation and released by The Tremco Mfg. Co., Cleveland, Ohio, is a discussion of waterproofing problems and solutions. Illustrated with more than 50 photographs and diagrams, the booklet explores such subjects as the various kinds of masonry; the effects of water absorption from without and vapor migration from within; and methods of caulking and pointing joints prior to the application of masonry preservatives. ----------**Item 69**

BUILDING SEWER PIPE BROCHURE—An 8-page illustrated brochure on building sewer pipe is issued by Johns-Manville, New York, N. Y. It contains information on asbestos-cement pipe for connecting house drains with street sewers or septic tanks. It describes and illustrates a coupling with factory pre-positioned rubber rings. Fittings also are covered, and there is a chart on various methods of pipe connection. ----------**Item 70**

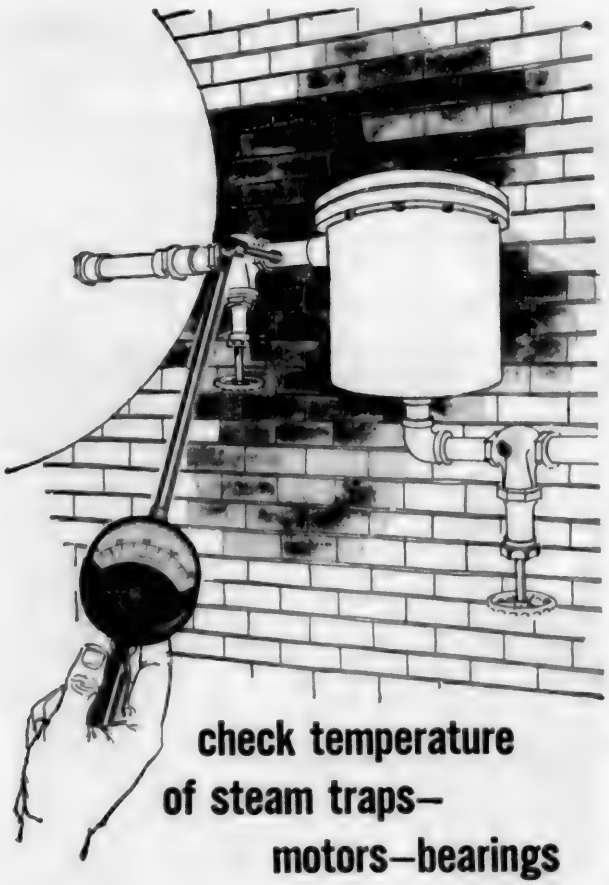
PROPELLER FAN BULLETIN—Two new models, a bypass duct fan and a double ring reversible fan are described in a 40-page propeller fan catalog, A-109A, published by Hartzell Propeller Fan Co., Piqua, Ohio. In addition to the information on the two new fans, specifications, dimensions, and performance figures are given on eighteen other types of industrial ventilating fans, intake units, unit heaters, and accessories. ----------**Item 71**

STAINLESS TUBING FOLDER—Information of interest to engineers and designers associated with the use of stainless tubing and pipe is included in a data folder, No. TB-355, published by Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa. The 6-page bulletin touches briefly on the attributes of stainless steel and how it can be fabricated. Also included are tables of analyses, mechanical properties, creep strength, physical properties, and oxidation resistance of nine stainless tubing steels. ----------**Item 72**

CONDENSER INSTALLATION MANUAL—An expanded installation manual No. M-5.3002, for a line of evaporative condensers is available from Drayer-Hanson, Inc., Los Angeles, Calif. Set forth are installation and maintenance instructions for evaporative condenser equipment in sizes ranging from 5 to 110 tons. Diagrams illustrate the dismantling and reassembly process, with a check list provided for the installing contractor. ----------**Item 73**

REGULATOR CATALOG—Details of the H9300 pressure regulator are presented in the W-96-A regulator catalog issued by Mueller Co., Decatur, Ill. Illustrated, the book contains specifications on the regulator as well as flow charts, installation information, and performance and engineering data. Design details are shown in cutaway views. ----------**Item 74**

(*Concluded on page* 176)



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 514, 420 N. LaSalle St., Chicago 10, Ill.

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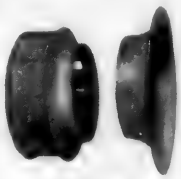
PRECISION INSTRUMENTS FOR EVERY INDUSTRY

INDUSTRY Breathes Easier with GENERAL mechanical lungs!

Shown here is a "General" backward blade centrifugal fan. Highly flexible in purpose or position it is designed for use in heating-ventilating and air conditioning systems, power plant installations and industrial processes. Non-overloading, quiet operation are inherent qualities in all General backward blade fans.



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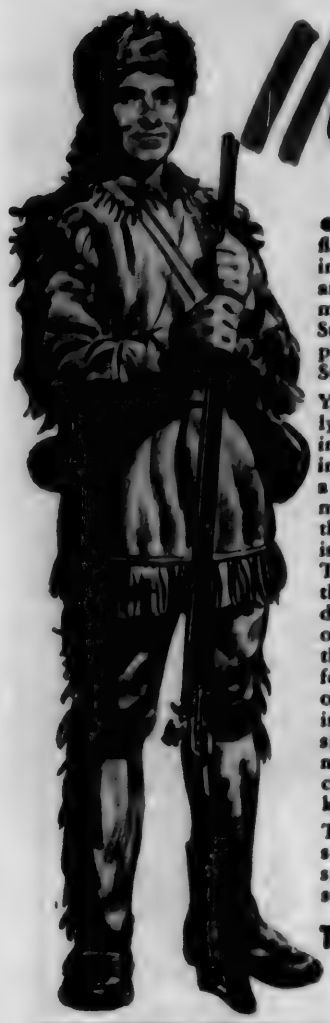
Greater efficiency, longer life, less maintenance cost are automatically yours in every General Blower product. Over twenty years experience in manufacturing heavy duty air moving equipment for the nation's leading industries is the guarantee of quality behind each blower leaving our plant.

Let General Blower engineering "know how" help you with your next air handling problem. Contact the engineering sales representative in your area or write General Blower Company.

GENERAL BLOWER COMPANY
8601 FERRIS AVENUE
MORTON GROVE, ILLINOIS

IT'S FLATTERING TO BE IMITATED



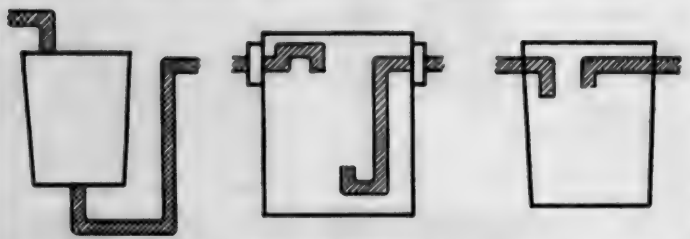
● Old Davy would be mighty flattered if he were here to see his imitators. We, too, at Anderson are flattered that so many trap manufacturers have imitated Super-Silvertop's straight-through piping. Such action acknowledges Super-Silvertop's leadership.

Years ago we discovered if properly designed a steam trap could be installed as an elbow or straight-in-line saving 9 pipe fittings and a half-hour's labor. Although many other traps are now using the straight-through design, there is still a basic important difference. They only offer the straight-through design and not optional design of either straight-through or elbow inlet connection. Also their design is available in only a few sizes and is obtained by means of building piping into the trap, instead of a truly engineered design. Built-in piping results in narrow, thin-walled, hard to clean, cored passages that can cause gaskets to blow.

The next time you buy or specify, select Super-Silvertops with straight-through and elbow installation . . . in all sizes.

THE V. D. ANDERSON CO.
1973 West 96th Street
Cleveland 2, Ohio

Only SUPER-SILVERTOPS offer Simplified Piping Without the Use of Narrow Thin-Walled Passages



This conventional design requires 9 fittings and complicated piping.

This design eliminates the fittings but results in narrow cored passages.

Only Super-Silvertop eliminates narrow-cored, thin-walled, passages.

SUPER-SILVERTOP

NEW CATALOGS

(Concluded from page 174)

DESIGN HANDBOOK—A 40-page design handbook covering the properties, specifications, applications, and design data on 20 grades of stainless steel wire, rod, and strip is available from Alloy Metal Wire Div., H. K. Porter Co., Inc., Prospect Park, Pa. The general theme of the handbook is The Functional Selection of Stainless Steels. Properties charts, size and weight charts, and other tabular data are also included to enable the design engineer to select the right grade of stainless steel for a particular application. ----- **Item 75**

VENTURI NOZZLE BULLETIN—A 4-page, color bulletin, No. 130-K3A, describing a Venturi insert nozzle for metering liquid, steam, air, or gas is available from Builders-Providence, Inc., Div., B-I-F Industries, Providence, R. I. Answers to capacity problems are given in a capacity table. Other sections of the bulletin give the accuracy, installation, and dimensions of the nozzle. ----- **Item 76**

DRY FLUID DRIVE BULLETIN—A 12-page bulletin, A-640, containing full color illustrations of the Flexidyne dry fluid drive is available from Dodge Mfg. Corp., Mishawaka, Ind. Cross sectional engineering drawings of the drive, selection charts, and list prices are given. ----- **Item 77**

FOLDER ON INSULATION BLOCK — A 4-page folder describing Duraface Foamglas insulation block is available from Pittsburgh Corning Corp., Pittsburgh, Pa. The folder describes the manufacturing process, lists physical properties, and details and sizes available. ----- **Item 78**

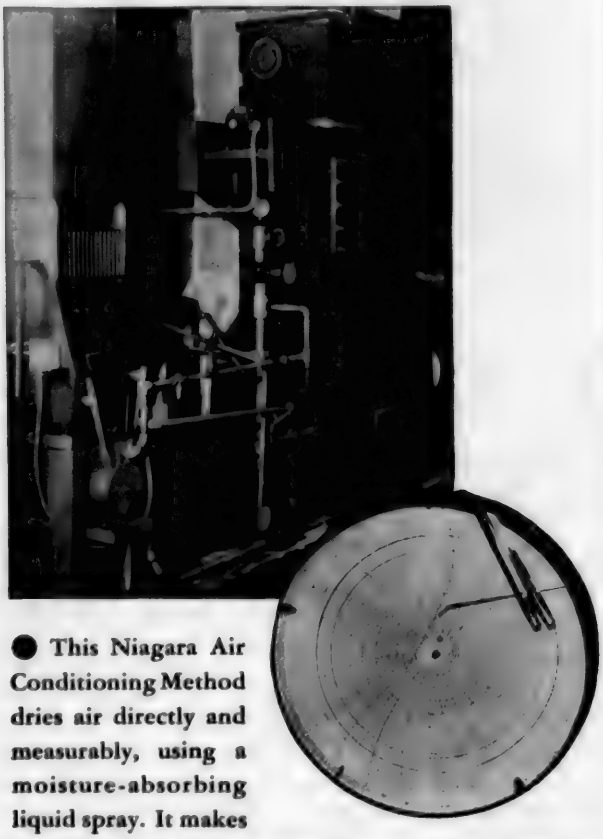
GUIDE TO DEFROSTING CONTROLS—A 4-page, 2-color catalog, No. 5544, featuring a line of time controls for refrigeration applications has been prepared by Paragon Electric Co., Two Rivers, Wis. Time controls designed for defrosting purposes and fan timers are illustrated and described in the guide. ----- **Item 79**

ENGINEERING DATA BOOK—A 16-page stainless steel engineering data book is published by Cooper Alloy Corp., Hillside, N. J. Compiled for use as part of the company's alloy catalog, the engineering data section includes design and dimensional information on flange drilling templates, flange and ring-joint facings, stainless steel pipe, pipe threads, thread engagement, pressure-temperature ratings and conversion factors, resistance of fluid flow, hardness conversion tables, metal casting factors, and a materials selection chart covering more than 300 corrosive solutions. ----- **Item 80**

PLUMBING REPAIR PARTS LIST — A booklet listing plumbing brass and repair parts for equipment contained in the company's K-56 catalog is available from Kohler Co., Kohler, Wis. The booklet is designed to aid customers select replacement parts for the company's fittings. Exploded views of the complete fittings are used throughout the book. ----- **Item 81**

Use the prepaid postcard on page 153 for securing your copies of catalogs described in this department.

EXACT CONTROL
of Moisture Content
To Improve Your Product or Protect Your Materials or for Processes or Tests



● This Niagara Air Conditioning Method dries air directly and measurably, using a moisture-absorbing liquid spray. It makes humidity control a separate function from lowering or raising temperatures and gives you precise control with thermostats alone; no moisture-sensitive devices are needed. You have simpler, more trustworthy, less expensive control instrumentation. Niagara precise-control installations have the best record for reliability.

Niagara Air Conditioning provides you with any temperature and relative humidity you need. Using "Hygrol" absorbent, it is not expensive to operate, saving the refrigeration commonly used to condense moisture and making re-heat unnecessary in most cases. It gives large capacity with compact, easily-maintained equipment. Ask for Descriptive Bulletins #112 and #121. Address Dept. HV.

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air patterns unlimited without blank-offs

AGITAIR *Custom Made*

AIR DIFFUSERS with DIFFUSING VANES

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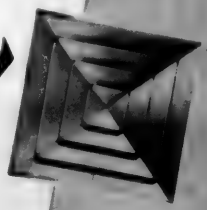
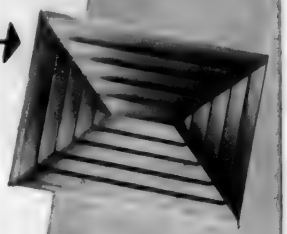
A good piece of equipment is no better than the experience behind it.



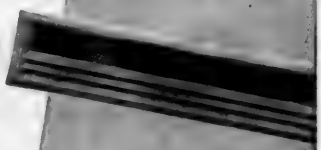
. . . better because

It's the original square and rectangular outlet . . . not just a poor imitation without distinctive features.



. . . better because

The company behind these diffusers has a history for doing things right and guaranteeing results.



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Your local AGITAIR representative will gladly assist you in selecting the proper size and air pattern to meet the requirements of your job. In addition, the engineering staff and laboratory resources of Air Devices Inc., are available to you.

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Air Diffusers • Filters • Exhausters

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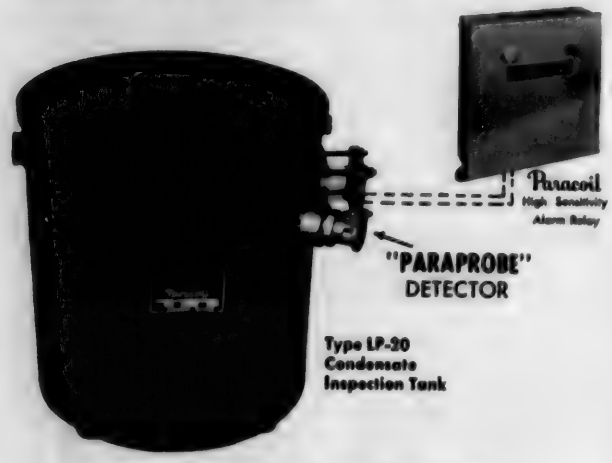
NEW!

Paracoil OIL-LEAK DETECTION SYSTEM for STEAM TYPE FUEL OIL HEATERS



Continuously Monitors the Purity of Condensate leaving Steam-Type Fuel Oil Heaters

- **Isolates all fuel oil entrained in the condensate stream**
- **Gives alarm to plant Personnel**
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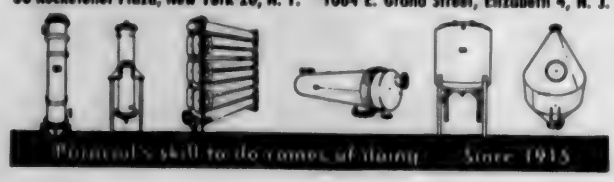


COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

GAMA MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at the El Mirador, Palm Springs, Calif. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York,. N. Y. . . . . **OCTOBER 12-14, 1955.**

AGA CONVENTION—1955 convention of the American Gas Association and the Pacific Coast Gas Association, at the Statler Hotel, Los Angeles, Calif. Secretary of the AGA, 420 Lexington Ave., New York 17, N. Y. . . . . **OCTOBER 17-19, 1955.**

WELDING SOCIETY MEETING—National fall meeting of the American Welding Society, at Bellevue-Stratford Hotel, Philadelphia, Pa. Secretary of the Society, 29 W. 39th St., New York 18, N. Y. . . . . **OCTOBER 17-21, 1955.**

ASA MEETING—Annual meeting of the American Standards Association, at the Sheraton Park Hotel, Washington, D.C. Secretary of the Association, 70 E. 45th St., New York 17, N. Y. . . . . **OCTOBER 24-26, 1955.**

INDUSTRIAL HYDRAULICS CONFERENCE—National Conference on Industrial Hydraulics, at the La Salle Hotel, Chicago, Ill., sponsored by Illinois Institute of Technology and Armour Research Foundation. Secretary, 35 W. 33rd St., Chicago 16, Ill. . . . . **OCTOBER 27-28, 1955.**

SOLAR ENERGY SYMPOSIUM—A World Symposium on Applied Solar Energy, sponsored by Stanford Research Institute, Stanford, Calif., to be held at Phoenix, Ariz. Chairman of the Institute, 612 S. Flower St., Room 332, Los Angeles 14, Calif. . . . . **NOVEMBER 1-5, 1955.**

ASME MEETING—75th anniversary meeting of the American Society of Mechanical Engineers, at the Hilton and Blackstone Hotels, Chicago, Ill. Secretary of the Society, 29 W. 39th St., New York, N. Y. . . . . **NOVEMBER 13-18, 1955.**

POWER EXPOSITION—Chicago Exposition of Power & Mechanical Engineering, at the Coliseum, Chicago, Ill., to be held under the auspices of The American Society of Mechanical Engineers, in conjunction with their 75th Anniversary meeting. E. K. Stevens, manager, International Exposition Co., Inc., 480 Lexington Ave., New York, N. Y. . . . . **NOVEMBER 14-18, 1955.**

AIR CONDITIONING WHOLESALERS MEETING—National convention of the National Heating and Air Conditioning Wholesalers, Inc., at Governor Clinton Hotel, New York, N. Y. Secretary, NHAW, 1200 W. Fifth Ave., Columbus 12, Ohio. . . . . **NOVEMBER 27-29, 1955.**

CHEMICAL ENGINEERS MEETING—Annual meeting of American Institute of Chemical Engineering, at the Statler Hotel, Detroit, Mich. Secretary of the Intsitute, 29 W. 39th St., New York 18, N. Y. . . . . **NOVEMBER 27-30,1955.**

REFRIGERATION EXPOSITION—9th Exposition of the Air-Conditioning and Refrigeration Industry, at Atlantic City, N. J., sponsored by the Air-Conditioning and Refrigeration Institute. The name of this trade show, formerly known as the All-Industry Refrigeration and Air Conditioning Exposition, has been officially changed. George Jones, executive secretary of the Institute, 1346 Connecticut Ave., N. W., Washington, D. C. . . . . **NOVEMBER 28—DECEMBER 1, 1955.**

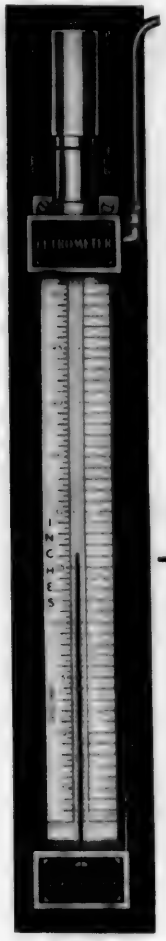
WARM AIR CONVENTION—42nd annual convention of the National Warm Air Heating and Air Conditioning Association, at Hotel Statler, New York, N. Y. Managing Director of the Association, 640 Engineers Building, Cleveland 14, Ohio. . . . . **NOVEMBER 30-DECEMBER 1, 1955.**

ASRE ANNUAL MEETING—51st annual meeting of the American Society of Refrigerating Engineers, at the Traymore Hotel, Atlantic City, N. J. R. C. Cross, secretary of the Society, 234 Fifth Ave., New York 1, N. Y. . . . . **DECEMBER 1-3, 1955.**

CHEMICAL INDUSTRIES EXPOSITION—25th exposition of Chemical Industries, at Commercial Museum and Convention Hall, Philadelphia, Pa. E. K. Stevens, manager, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. . . . . **DECEMBER 5-9, 1955.**

ATOMIC EXPOSITION—1955 Atomic Exposition, sponsored by American Institute of Chemical Engineers, at Municipal Auditorium and Annexes, Cleveland, Ohio. A. F. Denham, director of Atomic Exposition Management, 931 Book Building, Detroit 26, Mich. . . . . **DECEMBER 10-16, 1955.**

NUCLEAR CONGRESS—Nuclear Congress and Atomic Exposition, sponsored by the Engineers Joint Council, to be held at Municipal Auditorium, Cleveland, Ohio. Stewart E. Reimel, secretary of the Council, 29 W. 39th St., New York 18, N. Y. . . . . **DECEMBER 12-17, 1955.**



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Large, easy-to-read vertical scale gives tank contents at a glance. Scales are easily changed for different liquids.

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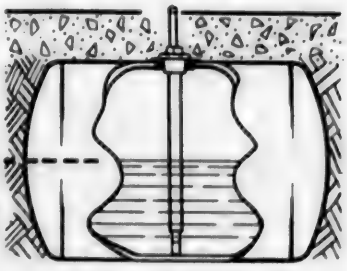

FOR TANKS 20 INCHES TO 50 FEET DEEP.

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only gas unit heating offers *all* these advantages

- **COMPLETE ADAPTABILITY TO FUTURE CONSTRUCTION** — internal remodeling or added space can easily be accomodated by merely shifting or adding a few units.
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- **EXTRA HEAT FOR TROUBLE SPOTS** such as areas facing large doors.

FOR HEATING

- STORES
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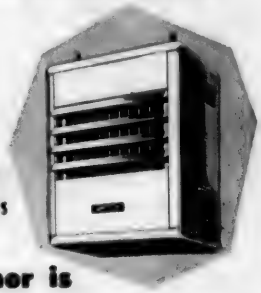
- AND MANY OTHERS



and here's why Reznor is **by far** the world's largest-selling gas unit heater

One out of every two gas unit heaters sold today is a Reznor. There are two reasons for this domination: "years-ahead" engineering and quality workmanship. An alert, aggressive product development program keeps Reznor ahead of the field in the introduction of improvements for greater heating efficiency, economy and comfort. High standards of craftsmanship and the use of only the finest materials and components insures for Reznor customers the full benefit of this engineering leadership.

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THE WORLD'S LARGEST-SELLING GAS UNIT **HEATERS**

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The New Type CY Permanent Split Capacitor MicroMotor ... by Redmond

This new Type CY MicroMotor makes practical, larger direct-drive blowers. Manufacturers can reduce installation costs by eliminating belts, blocks, pulleys and motor mounts required in conventional blower assemblies.

Major features of the Type CY motor include:

- Elimination of starting switches and relays.
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- Can be mounted in any position.

Typical Performance Data:

⅓ H.P. • 115 v. • 1075 r.p.m. • 5.4 amp. • 497 watts • 50% efficiency 80% Power Factor • 12.1 MFD capacitor.

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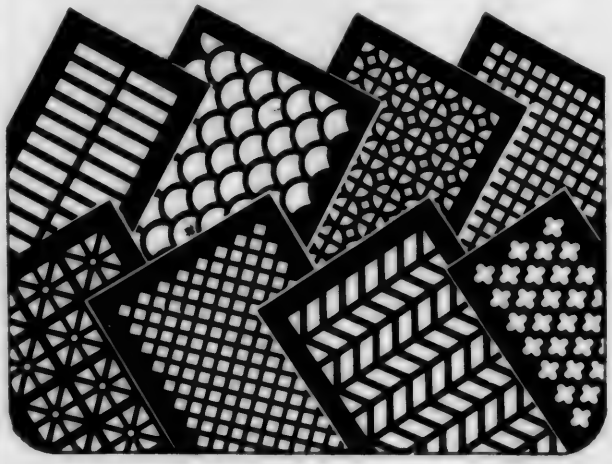

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AVOID cold-morning COMPLAINTS ..save fuel, too

The WEATHER-CHRON

positively ELIMINATES "cold-building" penalties and assures MORE fuel savings wherever heat may be set back at night or over the week-end. It automatically starts heating earlier on cold mornings, to assure comfort temperatures when wanted but on milder mornings it delays morning build-up. When outside temperatures rise above 65° F., the WEATHER-CHRON stops all heating. In extreme cold weather night setback is eliminated.

More than just a time switch. Upon installation you select your comfort hours and set the WEATHER-CHRON. After that the outside temperature does all the resetting.

It can be used in any space heating control circuit in any type of building where lowered night or week-end temperatures are desired.

Fully described in our new Bulletin #S-355. Write for it today.

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STAXAUSTER can be used to convert all types of roof ventilators into powerful exhaust or air supply units.

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EXHAUST FANS

Whether you are working on new construction or motorizing existing ventilators, Allen Exhaust Fans will be the top-performance, quality answer to the particular ventilating problem. Easy to install, economical to operate, these fans meet a wide range of needs. In addition to the Fan Section shown above, the line includes the Remote Drive Allen Staxauster, and for wall installations, the Allen Exhaust Fan and the Lo-Noiz-Level Multiblade Fan. Our representatives are in most principal cities; names listed in our catalog in Sweet's Architectural File, Section 20b.

Remote Drive Allen Staxauster
Specially designed for applications handling corrosives and/or high-temperature air.

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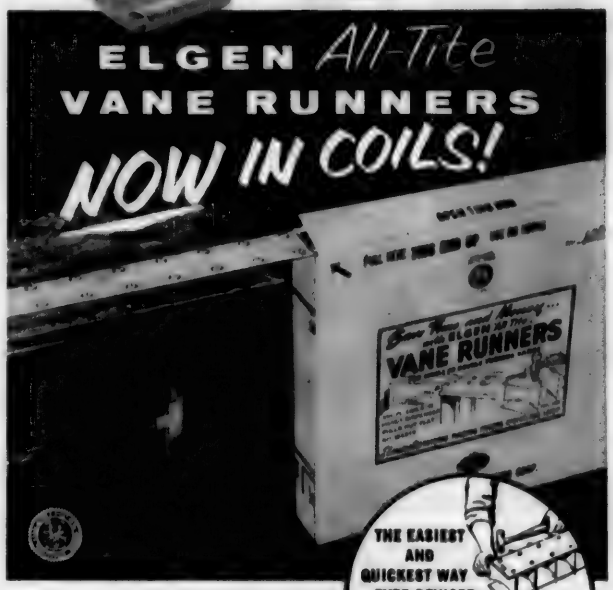

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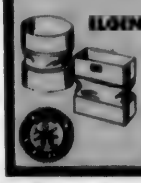

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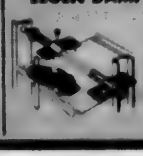

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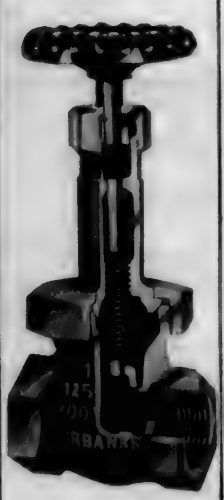

FIGURE U-0252
Rising Stem. Solid Wedge. Taper Seat. 125 Pounds Steam Working Pressure. 200 Pounds Cold Water, Oil or Gas Pressure. Non-Shock.

150 lb.

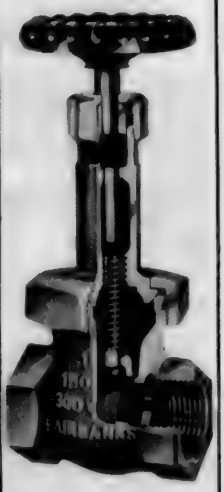

FIGURE U-0226
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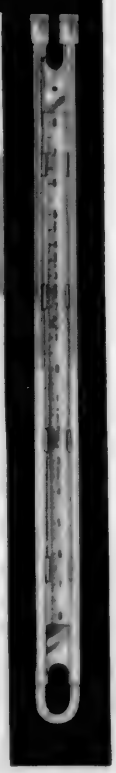

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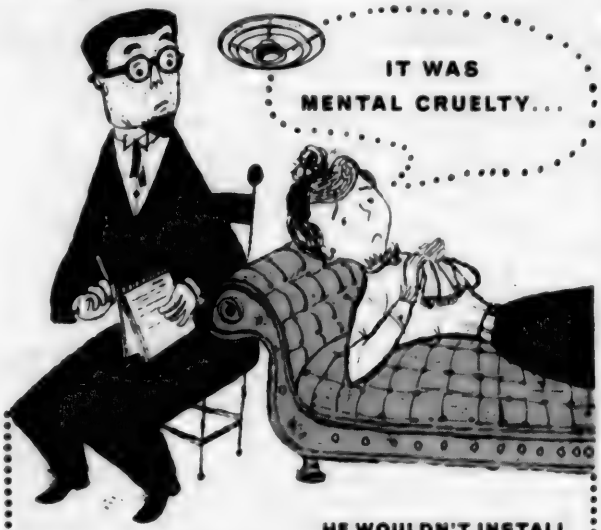

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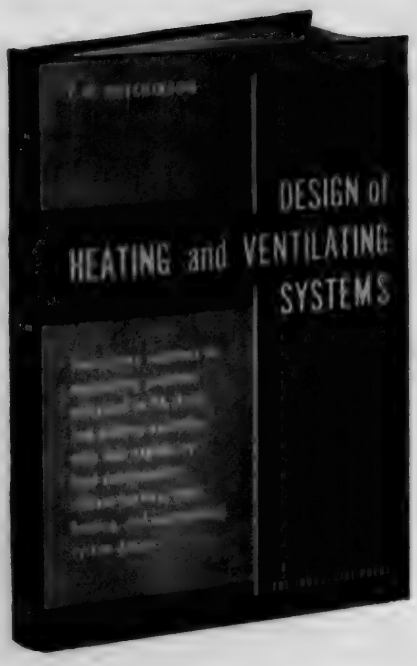

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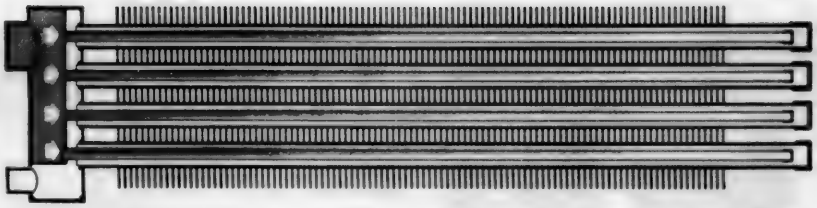

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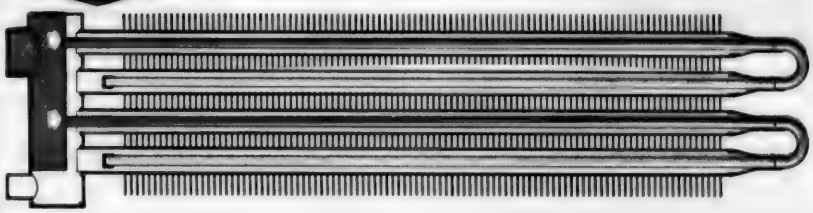

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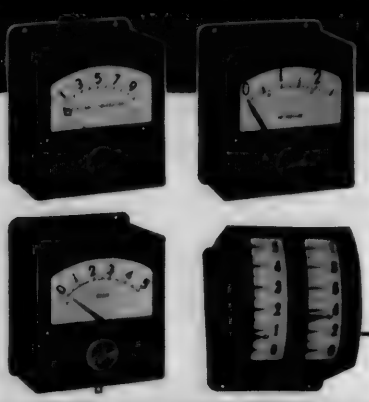

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ALPHABETICAL INDEX OF ADVERTISERS

A

Air Devices, Inc. 177
Air Filter Corp. 183
Airtherm Manufacturing Co. 170
Allen-Bradley Co. 147
Allen Cooler & Ventilator, Inc. . . . 181
Allen, W. D., Manufacturing Co. . 172
Allin Manufacturing Co. 182
Allis-Chalmers Manufacturing Co. 14-15-72
American Air Filter Co., Inc. 42-43
American Blower Corp. 60
American Brass Co. 47
American Machine & Metals, Inc. 1
American Radiator & Standard Sanitary Corp. 163
Ames Iron Works, Inc. 67
Anderson, V. D., Co. 176
Anemostat Corp. of America Insert 51-52
Armstrong Machine Works Inside Front Cover
Auer Register Co. 180
Automatic Devices Co., Inc. 181

B

Babcock & Wilcox Co., Boiler Dis. 83
Barber-Colman Co. 149
Bell & Gossett Co. 29-49
Bethlehem Steel Co. 151
Bishop & Babcock Mfg. Co. Massachusetts Blower Div. . . . 77
Boiler Engineering & Supply Co., Inc. 174
Brunner Manufacturing Co. 9
Buffalo Forge Co. 31

C

Carnes Corp. 56
Carrier Corp. 166
Chase Brass & Copper Co. . . Insert 69-70
Clarage Fan Co. . . . . Inside Back Cover
Classified Advertisements 186
Cleaver-Brooks Co., Boiler Div. . . 161
Cleveland Fuel Equipment Co. .186-187
Connor Engineering Corp. 37
Crane Co. 50
Curtis Refrigerating Machine Div., Curtis Manufacturing Co. 18

D

Davis Engineering Corp. 178
Debothezat Fans Div., American Machine & Metals, Inc. 1
Delta Heating Corp. 183
Detroit Controls Corp. 63
Dollinger Corp. 169
Duriron Co., Inc. 80
Dwyer, F. W., Mfg. Co. 182

E

Elgen Manufacturing Company . . 181

F

Fairbanks Co. 182
Farr Co. 40
Field Control Div., H. D. Conkey & Co. 173
Fitzgibbons Boiler Co., Inc. 46
Frick Company 38

G

Gallaher Co. 64
General Blower Co. 175
General Electric Co. 26
Gustin-Bacon Manufacturing Co. . 55

H

Halstead & Mitchell 145
Hoffman Specialty Mfg. Corp. . . . 79

I

Illinois Engineering Co. 16
Illinois Testing Laboratories, Inc. 175
Industrial Press 184
Infra Insulation, Inc. 7
Iron Fireman Mfg. Co., Selectemp Div. 35

J

Jenkins Bros. 85
Jenn-Air Products Co., Inc. 167
Johnson Service Co. . . . . Back Cover
Joy Manufacturing Co. 58

K

Kennard Corp. 32
Kramer Trenton Co. 171

L

L-O-F Glass Fibers Co. 62
Lewin-Mathes Co. 53
Liquidepth Indicators, Inc. 179

M

Maid-O'Mist, Inc. 61
Marlo Coil Co. 82
Marsh Heating Equipment Co. . . . 76
Massachusetts Blower Div., Bishop & Babcock Mfg. Co. 77
McDonnell & Miller, Inc. 19
McQuay, Inc. 73
Modine Manufacturing Co. 68
Myers, F. E. & Bro. Co. 59

N

Nash Engineering Co. 86
National Steel Corp., Weirton Steel Co. 41
National Tube Div., United States Steel Corp. 36
Nesbitt, John J., Inc. 11-185
New England Carbide Tool Co., Inc. 185
New York Blower Co. 71
Niagara Blower Co. 177

P

Patterson-Kelley Co., Inc. 157
Peerless of America, Inc. 165
Petro 54
Powers Regulator Co. 4-39
Pyle-National Co. 30

R

Ramset Fasteners, Inc. 168
Reading Tube Corp. 57
Redmond Co., Inc. 180
Revere Copper & Brass, Inc. 141
Reznor Manufacturing Co. 179
Ric-wil, Incorporated 48

S

Sarco Co., Inc. 74-159
Sarcotherm Controls, Inc. 159
Selectemp Div., Iron Fireman Mfg. Co. 35
Skidmore Corporation 27
Smith, H. B., Co., Inc. 81
Spence Engineering Co., Inc. 66
Standard Stamping & Perforating Co. 183
Struthers Wells Corp., Titusville Iron Works Co. Div. 65
Sturtevant Div., Westinghouse Electric Corp. 24-25
Superior Combustion Industries, Inc. 75

T

Titusville Iron Works Co. Div., Struthers Wells Corp. 65
Todd Shipyard Corp. 180
Trane Co. 44-45
Tube-Turns . . . . . Insert 33-34
Tuttle & Bailey, Inc. 12-13

U

Unistrut Products Co. 17
United States Steel Corp., National Tube Div. 36

W

Want Advertisements 186
Warren Webster & Co. 2
Watts Regulator Co. 188
Weil-McLain Co. 28
Weirton Steel Co., National Steel Corp. 41
Westinghouse Electric Corp., Sturtevant Div. 24-25
Wheeling Steel Corp. 22-23
Worthington Corp. 20-21

Y

York-Shipley, Inc. 84
Youngstown Sheet & Tube Co. . . . 78

Z

Zurn, J. A., Mfg. Co. 143

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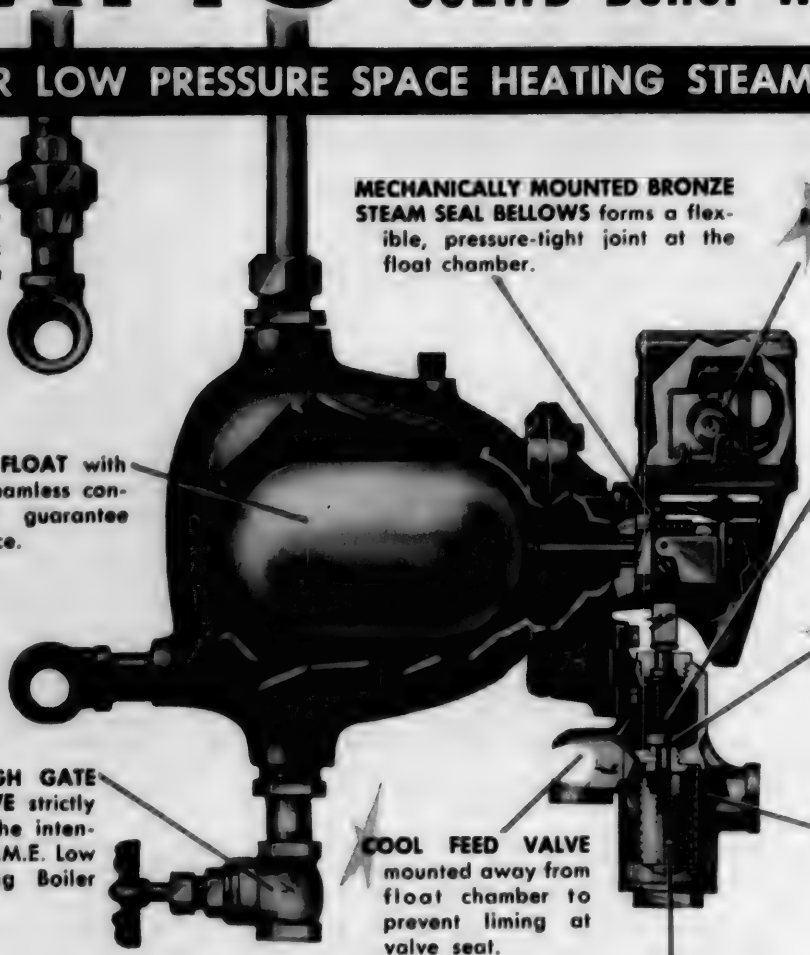

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WATTS 60 SERIES. Recently added refinements to the proven design of the Watts No. 60 establishes its unquestionable leadership in today's design of boiler water feeders. No better protection can be found.

No. 60 boiler water feeder only (without cut-off switch) for manually-fired steam boilers. An LWD mercury switch assembly may be added in the field at any time to make a combination boiler feeder and low water cut-off for automatic firing.

No. 60LWD. This feeder consolidates the No. 60 with a mercury switch assembly to provide a combination feeder and cut-off with alarm switch.

Series 60 capacity up to 5,000 sq. ft. of radiation. Maximum steam pressure 35 lbs. Maximum water pressure 150 lbs. Has ¼" tapping for pressure switch. Water valve connections ½" S.P.S. Gauge glass connections ½" S.P.S. Height (float chamber only) 8½". Width 5½". Length 12½". Weight 30 lbs.

NOTE: These starred features above make Watts feeders the most advanced boiler water feeders available on the market today.

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WATTS REGULATOR COMPANY

LAWRENCE, MASSACHUSETTS U.S.A.

STEAM LOSSES FROM STEEL PIPING — ½ TO 2 INCH PIPE

A	B	C	D	E	F	Nominal Pipe Diameter, Inches					
Temp. Diff., Deg.	Sat. Steam Temp. (Col. A +70 Deg.)	Abs. Steam Press. for Col. B Temp.	Latent Heat, Btu per Lb.	Heat Loss, Btu per Sq. Ft. per Hr.	Heat Loss, Lb. per Sq. Ft. per Hr.	½	¾	1	1¼	1½	2
						Outside Surface Area, Sq. Ft., per 100 Lineal Feet					
						21.99	27.49	34.43	43.46	49.74	62.18
						Pounds of Steam Lost per Hour per 100 Lineal Feet					
265	335	110	882.7	809.86	0.9175	20.18	25.22	31.59	39.87	45.64	57.05
270	340	118	878.5	833.88	0.9492	20.87	26.09	32.68	41.25	47.21	59.02
275	345	126	874.4	857.90	0.9811	21.57	26.97	33.78	42.64	48.80	61.00
280	350	135	870.2	881.92	1.0135	22.29	27.86	34.89	44.04	50.41	63.02
285	355	144	865.8	905.94	1.0464	23.01	28.77	36.03	45.48	52.05	65.07
290	360	153	861.7	929.96	1.0792	23.73	29.67	37.16	46.90	53.68	67.10
295	365	163	857.4	953.98	1.1126	24.47	30.59	38.31	48.35	55.34	69.18
300	370	173	853.0	978.00	1.1465	25.21	31.52	39.47	49.83	57.03	71.29
305	375	184	848.6	1007.14	1.1868	26.10	32.63	40.86	51.58	59.03	73.80
310	380	196	844.1	1036.28	1.2277	27.00	33.75	42.27	53.36	61.07	76.34
315	385	208	839.5	1065.42	1.2691	27.91	34.89	43.70	55.16	63.13	78.91
320	390	220	834.9	1094.56	1.3110	28.83	36.04	45.14	56.98	65.21	81.52
325	395	233	830.3	1123.70	1.3534	29.76	37.20	46.60	58.82	67.32	84.15
330	400	248	825.5	1152.84	1.3965	30.71	38.39	48.08	60.69	69.46	86.83
335	405	262	820.6	1181.98	1.4404	31.67	39.60	49.59	62.60	71.65	89.56
340	410	277	815.8	1211.12	1.4846	32.65	40.81	51.11	64.52	73.84	92.31
345	415	292	810.8	1240.26	1.5297	33.64	42.05	52.67	66.48	76.09	95.12
350	420	309	805.8	1269.40	1.5753	34.64	43.30	54.24	68.46	78.36	97.95
355	425	326	800.7	1303.86	1.6284	35.81	44.76	56.07	70.77	81.00	101.25
360	430	344	795.5	1338.32	1.6824	37.00	46.25	57.93	73.12	83.68	104.61
365	435	362	790.2	1372.78	1.7373	38.20	47.76	59.82	75.50	86.41	108.03
370	440	382	784.9	1407.24	1.7929	39.43	49.29	61.73	77.92	89.18	111.48
375	445	402	779.4	1441.70	1.8498	40.68	50.85	63.69	80.39	92.01	115.02
380	450	423	773.8	1476.16	1.9077	41.95	52.44	65.68	82.91	94.89	118.62
385	455	444	768.1	1510.62	1.9667	43.25	54.06	67.71	85.47	97.82	122.29
390	460	467	762.3	1545.08	2.0269	44.57	55.72	69.79	88.09	100.82	126.03
395	465	490	756.4	1579.54	2.0882	45.92	57.40	71.90	90.75	103.87	129.84
400	470	515	750.3	1614.00	2.1511	47.30	59.13	74.06	93.49	107.00	133.76
405	475	540	744.1	1657.66	2.2277	48.99	61.24	76.70	96.82	110.81	138.52
410	480	566	737.8	1701.32	2.3059	50.71	63.39	79.39	100.21	114.70	143.38
415	485	593	731.3	1744.98	2.3861	52.47	65.59	82.15	103.70	118.68	148.37
420	490	622	724.7	1788.64	2.4681	54.27	67.85	84.98	107.26	122.76	153.47
425	495	651	718.0	1832.30	2.5519	56.12	70.15	87.86	110.91	126.93	158.68
430	500	681	711.1	1875.96	2.6381	58.01	72.52	90.83	114.65	131.22	164.04
435	505	712	704.1	1919.62	2.7263	59.95	74.95	93.87	118.48	135.61	169.52
440	510	745	696.9	1963.28	2.8172	61.95	77.44	97.00	122.44	140.13	175.17
445	515	778	689.6	2006.94	2.9103	64.00	80.00	100.20	126.48	144.76	180.96
450	520	813	682.1	2050.60	3.0063	66.11	82.64	103.51	130.65	149.53	186.93
455	525	848	674.6	2104.54	3.1197	68.60	85.76	107.41	135.58	155.17	193.98
460	530	885	666.8	2158.48	3.2371	71.18	88.99	111.45	140.68	161.01	201.28
465	535	923	659.0	2212.42	3.3572	73.82	92.29	115.59	145.90	166.99	208.75
470	540	963	651.0	2266.36	3.4814	76.56	95.70	119.86	151.30	173.16	216.47
475	545	1003	642.8	2320.30	3.6097	79.38	99.23	124.28	156.88	179.55	224.45
480	550	1045	634.5	2374.24	3.7419	82.28	102.86	128.83	162.62	186.12	232.67
485	555	1089	626.1	2428.18	3.8783	85.28	106.61	133.53	168.55	192.91	241.15
490	560	1133	617.5	2482.12	4.0196	88.39	110.50	138.39	174.69	199.93	249.94
495	565	1180	608.7	2536.06	4.1664	91.62	114.53	143.45	181.07	207.24	259.07
500	570	1228	599.7	2590.00	4.3188	94.97	118.72	148.70	187.70	214.82	268.54

STEAM LOSSES FROM STEEL PIPING — 2½ TO 6 INCH PIPE

A	B	C	D	E	F	Nominal Pipe Diameter, Inches				
Temp. Diff., Deg.	Sat. Steam Temp. (Col. A +70 Deg.)	Abs. Steam Press. for Col. B Temp.	Latent Heat, Btu per Lb.	Heat Loss, Btu per Sq. Ft. per Hr.	Heat Loss, Lb. per Sq. Ft. per Hr.	2½	3	4	5	6
						Outside Surface Area, Sq. Ft., per 100 Lineal Feet				
						75.27	91.63	117.81	145.64	173.44
						Pounds of Steam Lost per Hour per 100 Lineal Feet				
50	120	1.692	1025.1	97.50	0.0951	7.16	8.71	11.20	13.85	16.49
55	125	1.941	1022.2	109.27	0.1069	8.05	9.80	12.59	15.57	18.54
60	130	2.221	1019.4	121.04	0.1187	8.93	10.88	13.98	17.29	20.59
65	135	2.536	1016.5	132.81	0.1307	9.84	11.98	15.40	19.04	22.67
70	140	2.887	1013.6	144.58	0.1426	10.73	13.07	16.80	20.77	24.73
75	145	3.280	1010.6	156.35	0.1547	11.64	14.18	18.23	22.53	26.83
80	150	3.716	1007.7	168.12	0.1668	12.56	15.28	19.65	24.29	28.93
85	155	4.201	1004.7	179.89	0.1790	13.47	16.40	21.09	26.07	31.05
90	160	4.739	1001.8	191.66	0.1913	14.40	17.53	22.54	27.86	33.18
95	165	5.334	998.8	203.43	0.2037	15.33	18.67	24.00	29.67	35.33
100	170	5.990	995.8	215.20	0.2161	16.27	19.80	25.46	31.47	37.48
105	175	6.716	992.8	229.68	0.2313	17.41	21.19	27.25	33.69	40.12
110	180	7.510	989.8	244.16	0.2467	18.57	22.61	29.06	35.93	42.79
115	185	8.382	986.8	258.64	0.2621	19.73	24.02	30.88	38.17	45.46
120	190	9.336	983.8	273.12	0.2776	20.89	25.44	32.70	40.43	48.15
125	195	10.385	980.8	287.60	0.2932	22.07	26.87	34.54	42.70	50.85
130	200	11.525	977.7	302.08	0.3090	23.26	28.31	36.40	45.00	53.59
135	205	12.772	974.6	316.56	0.3248	24.45	29.76	38.26	47.30	56.33
140	210	14.123	971.5	331.04	0.3408	25.65	31.23	40.15	49.63	59.11
145	215	16	968.3	345.52	0.3568	26.86	32.69	42.03	51.96	61.88
150	220	17	965.1	360.00	0.3730	28.08	34.18	43.94	54.32	64.69
155	225	19	961.7	377.30	0.3923	29.53	35.95	46.22	57.13	68.04
160	230	21	958.6	394.60	0.4116	30.98	37.71	48.49	59.95	71.39
165	235	23	955.0	411.90	0.4313	32.46	39.52	50.81	62.81	74.80
170	240	25	952.0	429.20	0.4508	33.93	41.31	53.11	65.65	78.19
175	245	27	949.0	446.50	0.4705	35.41	43.11	55.43	68.52	81.60
180	250	30	945.2	463.80	0.4907	36.93	44.96	57.81	71.47	85.11
185	255	33	941.2	481.10	0.5112	38.48	46.84	60.22	74.45	88.66
190	260	35	938.4	498.40	0.5311	39.98	48.66	62.57	77.35	92.11
195	265	39	934.4	515.70	0.5519	41.54	50.57	65.02	80.38	95.72
200	270	42	931.4	533.00	0.5723	43.08	52.44	67.42	83.35	99.26
205	275	45	928.2	553.48	0.5963	44.88	54.64	70.25	86.85	103.42
210	280	49	924.2	573.96	0.6210	46.74	56.90	73.16	90.44	107.71
215	285	53	920.9	594.44	0.6455	48.59	59.15	76.05	94.01	111.96
220	290	58	917.0	614.92	0.6706	50.48	61.45	79.00	97.67	116.31
225	295	62	913.4	635.40	0.6956	52.36	63.74	81.95	101.31	120.64
230	300	67	909.6	655.88	0.7211	54.28	66.07	84.95	105.02	125.07
235	305	72	906.0	676.36	0.7465	56.19	68.40	87.95	108.72	129.47
240	310	78	902.1	696.84	0.7725	58.15	70.78	91.01	112.51	133.98
245	315	84	898.3	717.32	0.7985	60.10	73.17	94.07	116.29	138.49
250	320	90	894.4	737.80	0.8249	62.09	75.59	97.18	120.14	143.07
255	325	96	890.6	761.82	0.8554	64.39	78.38	100.77	124.58	148.36
260	330	103	886.5	785.84	0.8865	66.73	81.23	104.44	129.11	153.75

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From this control panel in a typical processing area, a Johnson Record-O-Stat maintains and records constant wet and dry bulb temperatures. Water bottle, blower and motor are mounted below the Record-O-Stat. The air conditioning system at Greenville Mills is estimated to be the largest in Mississippi.

From raw wool to finished carpets—that's the story of the new Greenville Mills plant of Alexander Smith, Inc. Closely controlled temperatures and humidities, both for worker comfort and to safeguard sensitive processes, are essential to the efficiency of this modern plant. To maintain the exact conditions required in each area of the building, Greenville Mills depends on a specially designed system of Johnson Control. Here's how it works:

PROCESSING AREAS

Processing areas are divided into eight zones—carding, spinning, twisting, reverse twisting, setting and threading, weaving (2), and finishing. Conditioned air is supplied by from one to four air handling units per zone. Accurately controlling the temperature and humidity in each zone is a Johnson T-1020 Two-Pen Record-O-Stat which maintains and records constant wet and dry bulb temperatures.

Each Record-O-Stat operates a Johnson Three-Way Mixing Valve on the chilled water coils, Johnson V-103 Steam Valves on the steam reheat coils, and a Johnson V-105 Steam Valve on the grid humidifier on each of the air handling units. To insure accurate response under all conditions, all valves are equipped with Johnson V-510 Pilot Positioners.

For quick warm-up, hot water can be circulated through the cooling coils. A single, convenient switch provides the changeover.

SMOKE CONTROL FEATURE

A system of smoke dispersal is necessary in this windowless building. If smoke is detected in any unit, the return air damper automatically closes and the maximum outdoor air damper opens, increasing pressure inside the building and forcing the smoke out gravity roof ventilators. A manual switch at each control station will provide 100 per cent outdoor air at anytime.

OFFICES

Ideal temperatures in offices and other comfort areas are maintained by Johnson Individual Room Thermostats which regulate the supply of conditioned air from multi-zone air conditioning units. During the heating season, Johnson Master-Submaster Control automatically varies the heat supply in accordance with outdoor temperature.

OTHER SPACES

Other areas controlled include the laboratories, where control arrangements are similar to those in the processing sections. In the loading and stocking areas, strategically located Johnson Room Thermostats provide the desired temperatures by controlling Johnson Valves on ceiling-hung steam heating units.

Tens of thousands of buildings, of all types and sizes, depend on Johnson Control for the precision regulation of temperatures and humidities. In every case, simple or complex, the Johnson System is specifically designed to fit the exact needs of the individual building. Next time you have a problem, ask a nearby Johnson engineer for recommendations. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

**Greenville Mills, Inc., Greenville, Miss. (a division of Alexander Smith, Inc.). Mallett & Associates, architects and engineers, Jackson, Miss.; James F. O'Neil Co., heating and air conditioning contractor, New Orleans, La.*

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